

# SUPPLEMENT.

# The Mining Journal, RAILWAY AND COMMERCIAL GAZETTE:

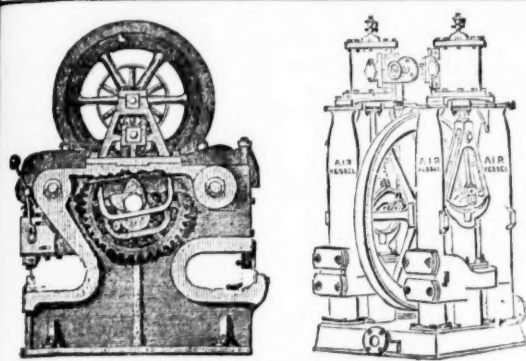
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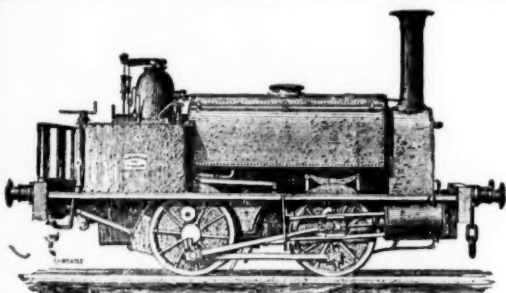
No. 1999.—VOL. XLIII.

LONDON. SATURDAY. DECEMBER 13. 1873.

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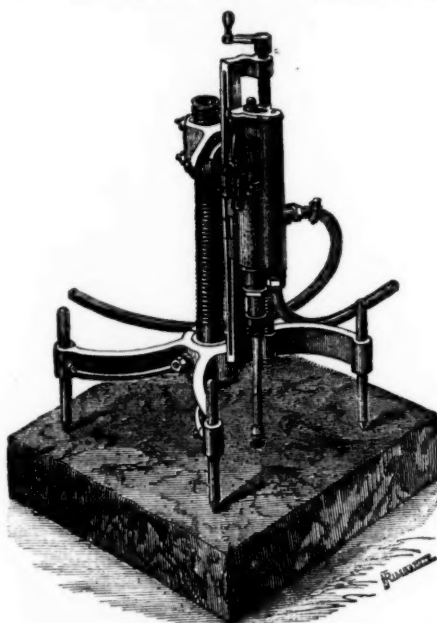


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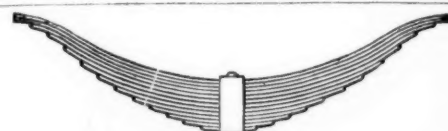
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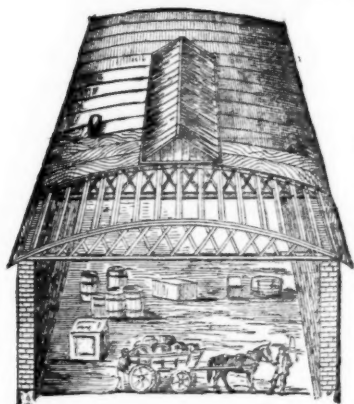
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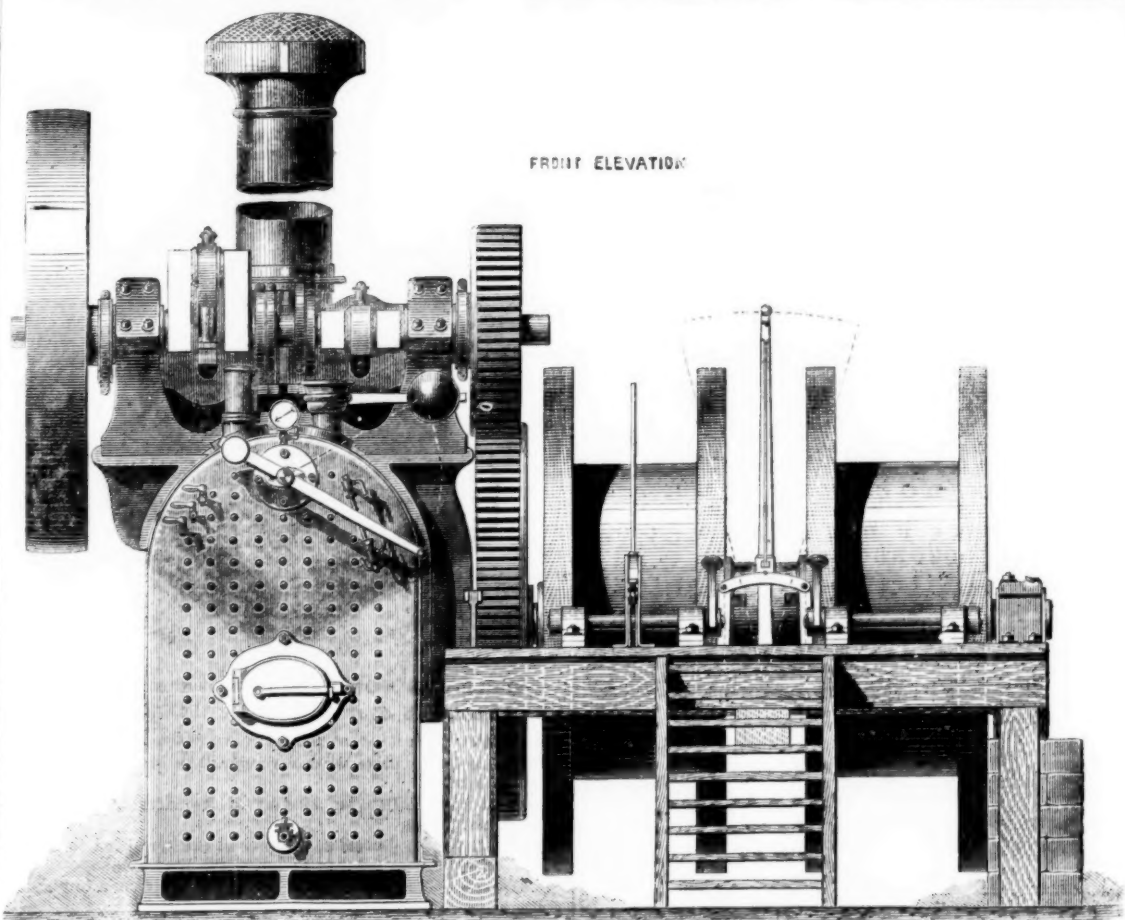
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## Original Correspondence.

## THE GOLD COAST OF AFRICA.

SEN.—As everything connected with the Ashantees and the Gold Coast of Africa may be considered interesting at the present moment, I make no apology for introducing this letter to your notice, if you can find room for it in your excellent Journal.

In September, 1867, at the breaking out of the Abyssinian war, the writer published a little book, entitled "The Hand-book of Abyssinia," which was very well received, and therein the following passage occurs (notes to page 12, line 35):—"Agooa is the name of a petty little kingdom on the Gold Coast of Africa, and there are two other places not far from Agooa, called Axim and Ankober (both Abyssinian names, the latter being that of the southern capital of Abyssinia, whilst Axim was the name of the central capital of this ancient and once mighty empire). There is another place, called Sabu, or Saba, adjoining the Gold Coast, formerly belonging to the kingdom of Whidah, which kingdom was conquered by the King of Dahomey and annexed in 1726."

This Agooa may have been the Agow of Cosmas, and a part, if not all, the Gold Coast a colony of the Axumites. Cosmas states that "every other year the King of Axum sent several persons of distinction to traffic with the natives of Agow (Query, Agooa) for gold." At this period the Abyssinians were acquainted with the art of navigation, and had recently imbibed the spirit of trade, and acquired the seaport of Adule or Zoola (now Annesley Bay), from which they penetrated along the African coast as far as the equator in search of gold, emeralds, and aromatics. But as Mr. Salt found Greek inscriptions amongst the ruins of Axum and also Adulis (in Annesley Bay) in 1805, this Adulis\* might have been originally one of the early Greek colonies, coeval with, or anterior to, the reign of David and Solomon, even before Axum became the central capital of Abyssinia; and it is quite possible that these enterprising people—the ancient Greeks—were the first to double the Cape of Good Hope, under the auspices of the reigning monarch of Abyssinia (Sheba), probably the great Queen Mareb, or Azeb, herself; and, query, did they, finding abundance of gold there, and a savage people worshipping a huge serpent, call it Ophir, from Ophus—a serpent or Python?

The Pythian games were established in renovated Greece about this time, the first year of the Olympiad, during the reigns of David and Solomon; and abundance of gold poured into Greece at this period, as well as Judea (see Chronicles I., xxi., 25, also xxii., 14; and Kings I., x., 16-29), probably brought from Agooa, or the neighbouring kingdoms of the Gold Coast. It is recorded in the early history of renovated Greece that a "Golden statue of Victory was placed in front of the Temple of Olympius, and a golden vase at each end of the roof. Beneath the statue hung a shield of beaten gold. Within the temple was the statue of the god, the work of one of the most famous sculptors that ever lived; it was of enormous size, made of flesh-coloured (stained) ivory and gold. Precious stones and painting and gold not only adorned the figure of the god, but the throne on which he sat." We must not forget that one of the ancient names of Africa was Olympius. Query, might not the first ship that rounded the Cape and discovered this wonderful gold coast conquered the inhabitants worshipping a great Python, and, bringing home such a quantity of gold, have been called the Apollo? And hence, through the medium of that all powerful agency—gold—might have arisen the sacred legend which instituted the Pythian games at Delphos, their generally received origin as connected with the Deucalian deluge notwithstanding. We must recollect that, according to the Hæthen Mythology, Deucalion was the son of Prometheus, the Egyptian Greek, who invented the art of statuary; and, having also invented the first ship for the Egyptians, and studied astronomy, might himself have commanded the good ship Apollo in this first voyage to the Gold Coast of Africa, for he afterwards became identified with Osiris, or the Apollo of the Egyptians. (See "Bryant's Analysis of Mythology," Vol. II., p. 273.)

The Greeks were the most enterprising followers or imitators of the Phœnicians, and amongst the first people smitten with the *aura sacra fames*; and we must bear in mind that the expedition to Colchis by the Argonauts, although it failed in bringing home the Golden Fleece, became sacred scripture in heathen mythology, and the ship Argo was afterwards constituted a constellation of the celestial globe. The three years' voyage to the Ophir of Solomon would also answer much better for the Gold Coast of Africa than Ceylon or Sofala, and these voyages might have been begun by enterprising Greeks, who emigrated out of the Peloponnesus, during the 80 years of Grecian obscurity after the Trojan war, and previous to the re-invasion of Greece by the Heraclidae. Besides Olympius, another of the ancient names of Africa was Lybia, so called from the granddaughter of Jupiter, and the great Egyptian god Osiris was synonymous with Jupiter, Apollo, Hercules, and Prometheus. After the description of the celebrated siege of Troy by Homer, the great bard describes Egyptian Thebes; and Greek inscriptions are found on the ruins of temples, &c., in this once enormous city to this day. Osiris was also worshipped at Heliopolis as Apollo, or the sun. Did not the Greeks, then, some years after the Trojan war, become identified, as it were, with Egypt? and hence the invasion of the Heraclidae from Egypt (not Asia), after which the Olympic games were established, and having acquired the knowledge of the Egyptians she became a powerful nation.

Dr. Doig, formerly master of the Grammar School at Stirling, came to the conclusion that the Ophir of Solomon was situated on the Gold Coast of Africa; and we may reasonably suppose that the fleets of Solomon and Hiram, after leaving the port of Eziongeber, or Elion, proceeded down the Red Sea with a fair wind to Adulis (now Annesley Bay), where they provisioned and recruited, having established relations with Azeb, the Queen of Saba, Sheba, or Abyssinia, waited there for the favourable monsoon, and then proceeded leisurely along the African coast, after passing the Straits of Babel Mandeb (the Gate of Death); and probably halting at Zanzibar or Delagoa Bay for favourable weather to round the Cape, thence proceeding along the west coast of Africa with the favourable southerly trade wind, and taking in their gold and ivory, apes and peacocks, at the rivers Volta, Prah, Ankober, Issini, Sherbro, Mattoniba, Gambia, &c. (the then colonial possessions of the Axumites); where they, perhaps, also collected the albug timber—a hard coral-coloured wood—probably what we now term the African oak, or it might have been the gum copal tree, which abounds at Sierra Leone (see 1st Kings, x., 11).† From thence they may have proceeded along the African shores to the great Phœnician port of Tarshish (now Cadiz or Seville, or Huelva), where they took in their silver, and continued their voyage by the Pillars of Hercules (Straits of Gibraltar) to Tyre and Joppa, thus occupying three years; or, if they returned from the Gold Coast without visiting Tarshish, still occupying three years.

Bruce considered that Sofala, on the S.E. coast of Africa, was the Ophir of Solomon, and that owing to the monsoons it would actually take three years to go to Sofala and return to Eziongeber; but I rather agree with Dr. Doig, backed, as it seems to be, by the writings of Cosmas. I have in my possession an old map of the Gold Coast, published in 1729 by M. D'Anville, in which he places a range of mountains some 12 leagues inland of Agooa and Accra, washed by the river Volta, called Tafu—marked in the map as "abounding in gold;" near which is a province called Quaku, also marked "rich in gold." These mountains are now considered sacred, and from religious feelings are not allowed to be worked in the present day, and the natives are very jealous of their position being known. The quantity of gold imported in the three years by Solomon was

\* Dr. Lumsdaine (attached to the Abyssinian Expedition of 1867-68) after making a slight excavation under the mounds at the ruins of Adulis found the bronze balance and chain of a pair of scales. Query—Might not these ancient scales have been used by the Axumites for weighing gold brought from the Gold Coast?

† David was the ancient name of the western branch of the Nile at Merce, and where probably the Peloponnesians established themselves, calling the kingdom Doris, after the Dorians of Greece; the first Dorus (coeval with Prometheus) probably having settled in Thessaly, from Egypt, at an earlier period. The ancient Greeks had several colonies called Doris or Doris.

‡ The Cedars of Lebanon and pine timber of Judea were too soft for columns or staircases for which the albug or albug trees were used.

§ Accra is evidently a Phœnician name; the ancient name of St. Jean d'Acre, on the coast of Syria, was Accra.

above fourteen millions sterling (2000 talents, 2nd Chron., ix, 13.) There is no doubt but Pharaoh Necho's orders for the voyage round Africa some 600 years B.C. was carried out after his successful raid in Judea (see 2nd Kings, xxiii., 29, and 2nd Chron., xxxv., 20, 21), where he would see with his own eyes the splendour of the Temple at Jerusalem, and learn from whence Solomon had obtained so much gold; and although there is nothing on record as to his ships bringing home gold on this voyage, yet there is little doubt but that Ophir was re-discovered on this occasion, notwithstanding the secrecy of the Phœnician and Jewish pilots, and may have determined this enterprising monarch afterwards to commence the canal from the Nile at or near Bubastes into the bitter lake and on to Suez, the depth of water at the mouth of the Nile and that of the river itself leading up to Bubastes being at that time, in all probability, sufficient for the largest ships. It is said that 100,000 people perished in digging this canal, and that it was at the death of Necho carried on by Darius, and ultimately finished by Ptolemy II. Herodotus states that it was in use in his day, some 450 years B.C. (See his "Euterpe," p. 158; also his "Melpomene," p. 39; see also Diodorus, Strabo, and Pliny.) Nevertheless, who shall decide when such authorities differ? Be that as it may, no doubt the voyage of Pharaoh Necho's ships was effected, for we find that some 25 or 30 years only after this period the voyage of Hanno was undertaken by the opposite route to look for Ophir; and although nothing is said in the "Periplus" as to the discovery of gold on this voyage, there is no doubt but that Hanno got as far as Sherbro, a little beyond the Gambia, and but for the timidity of the Carthaginian soothsayers on board the fleet, and the want of provisions, a few days' sail further would have brought them to the Gold Coast. Whether the barter for gold with the Lybians by the Carthaginians, far beyond the pillars of Hercules (Query, Ophir), by dumb signs, as recorded by Herodotus, took place before or after the voyage of Hanno is unknown. (See "Rennel's Dissertations on Herodotus, &c.," Vol. II.)

The natives of this coast, to the present day, worship the great Python, or harmless serpent of that country, rearing temples to its honour, and worshipping it as a god! A friend of the writer, a large Liverpool shipowner and African merchant, related to him the other day a circumstance that happened on board one of his ships a few years ago. The crew had been allowed to go on shore, and in the woods they killed a large serpent, which they brought on board. The priests heard of it, complained to the king, and all trading was immediately stopped, but the ship was allowed to remain for a certain period, by the payment of a fine, until trading was resumed. In the meantime the priests came on board the ship, and carried the body of the serpent on shore, proceeding with it to their temple with great processional pomp. This affair caused a great loss to the owners, Messrs. Stuart and Douglas, of Liverpool, and strict orders were given to the captains and supercargoes afterwards not to attempt the destruction of any more snakes or serpents.

British missionaries on this coast have long endeavoured to put down this fetishism,† but the native priests point to the 4th and 7th chapters of Exodus, and 9th verse of 21st of Numbers—in the Bibles distributed amongst them by the Bible Society, translated into their native language—and cunningly draw arguments in favour of utterly destroying their enemies from the books of Joshua, Samuel, Kings, Chronicles, &c., where they think they have divine authority for exterminating their enemies and decapitating their prisoners! They also worship, or did worship, idols in groves, like the Canaanites; and a tribe of the Abyssinians, called Agows, residing at Lasta and Damut, in Abyssinia, supposed by Bruce and Salt to have been the descendants of the Canaanites driven out of Canaan by the Jews (see Joshua xi, 23), also pay divine honours to the rivers Nile and Taccazzi, as the natives of the Gold Coast do to the sea at the present time. They also circumcise both sexes during infancy, like the Abyssinians, saying this custom was handed down to them by their ancestors, and they conduct their funerals in the same way as the Abyssinians, holding drunken wakes, and howling over the deceased like the lower Irish.

The two kingdoms of Akim and Akanni are marked in M. D'Anville's map as being "very powerful, and rich in gold;" but they do not work their gold mines in the present day, owing to religious scruples, and are very jealous of their positions being known, as before remarked, but merely accumulate such God-sent gold as becomes disintegrated, and is washed down by the rivers in the rainy season; and there is no doubt, from the tenor of this map and the geographical writings of Ogilby, Miller, Salmon, and others, that if the gold mines were thrown open and worked, like those of California, Australia, and New Zealand, any amount of the precious metal might be produced under the tuition of English, American, or Australian miners; and King Koffee could easily procure sufficient gold not only to pay all the expenses of this untoward war, but an annual tribute of a million or more, if compelled so to do.

Adjoining the town of Little Kommenda, or Abrohi, near these, lies a hill which is marked in the map—"contains much gold." This mine caused the Castle of Las Minas (Elmina) to be erected by the Portuguese; but in 1622, as the natives were working it, the ground fell in for want of props, and the miners were all smothered, so that Gueffia, King of Kommenda, issued an edict that no one was to dig any more in this hill, and up to the end of the 18th century it has never been attempted, or even perhaps to the present day, as they affirm that apparitions of golden dogs are seen in the mine (query, identical with the Egyptian god Anubis?) and other imps are conjured up by fear, to prevent the legitimate working of the mines, which are now considered sacred, but if precraft can be put down in this respect no doubt abundance of the precious metal would be forthcoming from this wonderful country.

The quantity of gold named by David in his address to Solomon (see Chronicles I., xxii, 14) was enormous—100,000 talents of gold; reckoning a talent as only worth 7000, in round numbers it would equal 700,000,000 sterling, besides 1,000,000 talents of silver, all of which he had "proposed for building the house of the Lord." Is not the Hebrew word *kikkar* wrongly translated? Should it not be *bars*, and not talents? For even this would have been an enormous amount, reckoning each bar at only 500 sterling for the gold and 200 for the silver, which would give 5,000,000,000 in gold and 20,000,000,000 in silver.

I have not been able to ascertain whether the Ashantees proper are in general of the regular negro type, with flat noses, thick lips, and woolly hair, or whether they are of the Abyssinian or Sikh tribe of negroes.‡ If the latter, it would seem to confirm the writings of Cosmas, and that the Axumites, under Grecian leaders, had planted a colony on this coast some 2900 years ago. Bosman, who was for many years a resident at St. George de las Minas—a fortress taken by the Dutch from the Portuguese in 1533, and lately ceded to the English, now called 'Elmina,' (the seeming cause of the present war), says, as quoted in "Miller's Geography"—"That the kingdom of Agooa is governed by a woman, and has ever been so governed, the eldest daughter being made Queen at the death of the sovereign. She contracts a sort of Morganatic marriage with the handsomest slave of her choice, and her sons are sold as slaves, the daughters having the privileges of Princesses. Wimba, the principal town on the sea coast, lies about 15 leagues to the eastward of Elmina. May not this anti-Salique law have been inherited from Mareb, or Azeb, Queen of Sheba? showing by inference that this part of Africa was really an Axumite colony during the reign of that powerful Queen, whose dominions extended from Merce, on the borders of Egypt, to the great lakes. She is said in the Bible to have come "from the uttermost parts of the earth to hear the wisdom of Solomon," and might have told him of her colonial golden possessions beyond the southern Cape. I have myself seen negro slaves at Rio de Janeiro and Maranhão, said to have been brought from the Gold Coast, with decided Ethiopian features, like the Sikhs in India, with long black hair and aquiline noses. It is also said that numbers of the natives of the Congo are of decidedly Ethiopian features, quite different to the ordinary negro of Nigritia.

King John of Portugal dispatched Cavillam and Payo to look for Prester John, after he had first heard of him through the Portuguese

\* The opinion of M. Lessoppe would be valuable on this point.  
† This harmless Python is said to destroy and eat up the venomous snakes.  
‡ Ashangy is the name of a lake in Abyssinia, and evidently Ashantees is an Abyssinian name.

commander Camm, or Caon, who discovered the River Congo, in 1484, and was there told of a powerful Christian King reigning in Abyssinia, from the southern parts of whose dominions this river came. This Cavillam arrived in Abyssinia, via the Red Sea, in 1490, and having been informed that a passage existed round the southern promontory of Africa, he procured a chart and sent it to King John; and a few years afterwards, in the reign of Emanuel, Vasco de Gama was dispatched to make the voyage to India by the Cape of Good Hope, in which he succeeded in 1497, passing it on Nov. 20, and making the land again, far to the N.E., on Christmas Day of that year, calling it Natal, or the Nativity, from this circumstance, which name it still retains.

Now, it seems probable that the southern extremity of the Abyssinian Empire, called Narea, or Enarea, may have reached the great lakes called Zaffan, Zaire, and Zembre (as shown in an old map published in the reign of Charles II., by Jacobus Murcium in Latin), from the former of which lakes one branch of the Nile is made to flow, and another branch from the Zaire; and the Congo is made to flow from the united Zaire and Zembre lakes, extending to latitude 12° south, no doubt the same lakes re-discovered by Grant, Speke, Livingstone, and Baker, although not in the same longitude.

The fame of Prester John may have been easily conveyed by the Congo to the mouth of that river; and it is very probable that the large quantity of gold said to have been brought into Abyssinia, via Enarea, by the Kaffirs,\* or Agows, came from the coast of Guinea by the Congo, and stimulated the Axumites to search for it by sea. It is well known that in early days the caravans which came to Morocco across the desert brought gold from countries beyond the Gambia; and it is recorded in Herodotus that the Carthaginians traded for gold with a black nation in Lybia, far beyond the pillars of Hercules, some 500 years B.C. According to Bosman (before named) the rainy season on the Gold Coast is pretty well over by the early part of September, and the evenings are cool—indeed, may be called cold, although from 9 in the morning to 3 P.M. it is very hot, even during the winter season, or from October to March, but this is the healthiest part of the year. This cold feeling at early morn is, no doubt, caused by the evaporation of the very heavy dew which falls at night. The writer was on the West Coast of Africa in charge of an exploring expedition a few years since, and, although the sun was near the zenith at noon, the nights and mornings before sunrise felt really cold, the thermometer ranging between 50° and 60°, and seldom reaching 80° in the shade, even during the day. Heavy rollers set in very frequently from the sea, owing to distant gales of wind blowing in the South Atlantic, the waves rolling on and on till they find a shore to break upon; and it is difficult to land on any part of the coast at all seasons, although there are periods of tolerable smooth water between the setting in of these terrible rollers as the successive distant gales near Cape Horn come and go. Matthews, who visited Sierra Leone in the early part of the present century, says "Cotton of three natural colours is grown in this neighbourhood, white, pink, and nankeen, and by careful cultivation could be produced to any amount; and the best indigo in the world grows wild in every part of the country." He also confirms the statement of circumcision being performed on the children of both sexes, the girls undergoing this sacred rite on arriving at the age of puberty at the hands of the priests, with mystic ceremonies like those of the Bona Dea or Cybele among the ancient Greeks and Romans.

The Gold Coast lies nearly east and west, and extends nearly 200 miles, or from the River Issini to the River Volta, embracing the coast line of some 12 petty kingdoms; the River Volta separates the British Protectorate from the Kingdom of Dahomey. The Issini is said to rise some 400 miles in the interior, but is only navigable for boats; there was formerly a French fort at its entrance. The Rio del Oro, or River of Gold, and the Rio Manco have the settlement of Apollonia about half-way between them. Next to the Manco is the Rio del Ankober, which rises in the kingdom of Wassa, passing through that of Egwira—"both rich in gold." About seven miles to the north-west of Cape Three Points is the old fortress of Fredericksburg, which once belonged to the Prussians, but they sold it to the Dutch in the early part of the 18th century; they also at one time held a fortress on Cape Three Points, and another called Dorothea, about three leagues to the eastward of the Cape, which was taken by the Dutch in 1643. The next place of any note is Sakkundi, which at one time produced "large quantities of gold" in barter. We then come to the River Prah, the sacred stream of the Ashantees, where poor Capt. Commerell was so seriously wounded. This river was formerly called St. John, and also St. George, in some old maps. It also separates the kingdom of Ashantee from its powerful and rich neighbours—the Akims and the Akanni—who, it is hoped, are allied with the Fantees on our side. A few miles beyond the Prah is the gold mine before named in the kingdom of Kommenda, or Kommamy, close to the town of Kotoberi, and stream of Abrohi before named, where a fortress was built by the Dutch in the year 1688. Nine miles from this is the fortress of Elmina before named. About eight miles to the eastward of this lies Cape Corso; it is a projecting promontory resembling a corpse from one point of view, hence the name now called Cape Coast. It is on this fortress, by the latest account, the Ashantees are marching.

There seems to be a feeling on the part of some of our very clever politicians, who know little of geography, and less of the resources of any country, that we ought to abandon the Protectorate of this Gold Coast, and supply the natives *ad libitum* with Bibles, Brummagen muskets, Sheffield blades, spirits, and gunpowder, to their heart's content; so that with the Bible in one hand, and a two-edged coultar in the other, they may freely go forth and slay their harmless neighbours, and cut off their heads, *secundum artem*, as long as they will barter gold for these much-coveted luxuries of the "untutored savage." No doubt there has been a great deal of bad management in the government of this British Protectorate for some years past, and the result is now seen by our having drifted into an untoward war with the Ashantees that will cost a thousand times more than the black-mail we ought to have known was to have been paid to King Koffee for the privilege of living quietly at St. George de las Minas.

However, this question having now assumed a phase where British honour is involved, we are bound to subdue these savages at all cost; and as "out of evil comes good," let us hope that having succeeded in this respect we shall see the necessity of promoting civilisation here by the endowment of public schools, like those at Lagos, and other parts of civilised Africa. Next annul their stupid superstitions as to sacred gold mines, and evil geni in mines (once prevalent in Cornwall), and by all means appoint missionaries—good Negro missionaries, if possible—who will teach the pure religion of Jesus Christ, and pay them well to prevent their trading. Do not allow the Bible to become a *fetish*, as at present, but leave it at home—at least that portion of it which, in respect to the bloody wars of the Jews, has nothing whatever to do with Christianity, and does much harm! Inculcate industry in tilling the ground and producing food and raw textile material. Encourage or enforce the wearing of suitable apparel, like our free and independent negroes in the West Indies. Prevent the indiscriminate importation of muskets, swords, coultars, daggers, spirits, and gunpowder, and substitute the miner's pick, the shovel, and the hoe. Compel the chiefs, or *kings* as they call themselves, to "seek peace and ensue it." Encourage legitimate gold mining, the staple produce of the soil, and introduce miners to teach them the art; and by placing an export duty on the gold, a large revenue will be raised for supporting the Government without taxing the British dominions—in short, make the Gold Coast an integral part of these dominions.

Thus the inscrutable ways of Providence may, by the present un-

\* Kaffir, in the Geze language, signifies a heathen, or pagan, the same as Agow.  
† Apollonia were feasts sacred to Apollo, instituted in consequence of Apollo conquering the Python. The true Apollo was that of Egypt. Orus, the son of Osiris, or Prometheus, afterwards worshipped in Greece as Apollo. See the Hymn of Callimachus:—

"The monstrous Python durst tempt thy wrath in vain,  
For dead he fell; to thy great strength  
And golden arms unequal."

Beneath his steps the yellow mineral rises,  
And Earth reveals her treasures."  
The native traditional names of localities on this coast were no doubt retained by the Portuguese.



looked-for war, eventually bring about happiness to some 5,000,000 of human beings, who are at present suffering more misery than when the foreign slave trade, with all its horrors, was in full force, and also prove the means of establishing a universal specie currency, and prevention of these lamentable panics in the money market which bring such misery into the families of a civilised community.—I am, Sir, your constant reader.

GEORGE PEACOCK, F.R.G.S.,  
Formerly a Master in the Royal Navy.

P.S.—I find the usual value of ancient bars of gold was 72½ each, and 100 of such bars went to a talent; whilst a bar of silver, much larger in bulk, was worth about 20½, so that 100,000 of these kikkaras (bars or ingots) would represent in gold about 7,200,000½, and the 1,000,000 kikkaras of silver to 20,000,000½, or about 27,200,000½ sterling in round numbers, instead of the enormous and incredible sum named in talents by (?) a wrong translation of the word kikkar. (See Chronicles I., xxii., 14.)

#### THE UTAH SILVER MINING COMPANY.

SIR.—Will you kindly allow me a short space in your columns to reply to a letter in the Journal of Oct. 25, signed "Large Shareholder?" Perhaps that gentleman will kindly inform me the date of the letter in which I promised dividends this autumn, as I have searched in vain the copies of my letters and reports, and cannot even find any expressions that are capable of being twisted into such a promise. Neither can I find any extraordinary tales in the letters written shortly after my arrival; but on the contrary, my residence here for three months enables me to confirm the statements I then made with regard to the ore and lodes, which is briefly this: that for the extent of ground opened the quantity of ore is very large, and almost unrivalled.

I have made two promises. Firstly, that if supplied with funds I would erect the machinery and get the dressing-floors at work this autumn; and secondly, that I would dress the ore up to 70 or 75 per cent. of lead. If large shareholders would kindly pay up their calls promptly, and endeavour to get their fellow-shareholders to do the same, thus giving substantial assistance to the work commenced, instead of publishing statements that, to say the least, are not correct, it would be much more to their own advantage and of those associated with them; and they would find that by performing their part of the bargain my promises would be promptly fulfilled, and I have every confidence that the much-desired dividends would soon follow. Respecting the Van Mine, to which the writer refers, I had the great pleasure and privilege in July last of going through the principal levels and stopes of that mine, and can safely say, without the least desire to detract from the renown of that justly famous mine, that if "Large Shareholder" will favour me with a visit I will show him courses of ore such as were never seen in the Van Mine, or probably any other in England. There are courses of galena in the Utah Mine 10 to 20 ft. wide, averaging 15 to 25 per cent. of lead, whilst the ore from the Van averages about 8 to 9 per cent.; ore of that quality we do not expect to raise at all.

I do not understand why American mines should be expected to pay dividends the moment work is commenced. In England and elsewhere people first develop the mines, lay open the ground, get their works and machinery into efficient order, and then if the mine opens up well, they can pay dividends, and carry on the enterprise with regularity. But here the ore must be rooted out at any cost and risk, either sold or smelted immediately, whether in a fit state or not, in order that dividends may be paid quickly; in fact, often before the money has been received. This spasmodic proceeding has been one of the chief causes of ruin to many of the mines that have so lamentably failed in these regions.

Perhaps "Large Shareholder" will allow me to refer him to the company's office, where I have no doubt very full information respecting the mine will be most readily communicated.

Bingham Canyon, Utah, Nov. 14. JOHN LONGMAID.

#### BLUE TENT HYDRAULIC MINING COMPANY.

SIR.—In the Mining Journal of Oct. 25, in reporting the meeting of the company, the Chairman, in reply to a shareholder's enquiry in reference to the actual amount of gold taken out of the property, stated that Prof. Silliman and Mr. McLean estimates the value of the gravel at 10c to 30c per yard; but states it is more desirable to estimate by the amount of water. In the first place, 10c per yard will scarcely show a colour. To base a calculation there must be a test of the quality of the gravel by actual yield, which can only be ascertained by washing off a certain measured portion by a certain quantity of water, hence the calculation for effective yield by rule of three. If 1000 in. washes off so many yards a-day, how much will 3000 or 5000 in. wash? And again, if so many yards yield so much gold, how much will so many yield? I say nothing about the value of the Blue Tent property, but I presume Mr. McLean inspected for the North American Gold Mining Company, and strongly recommended it; and which so far has proved an entire failure, and Mr. Silliman recommended the purchase of the Emma Mine.

It is a fact that there are several hundreds of thousands of acres of auriferous gravel deposits in the State of California unworked, and accessible and open to enterprise, and can be made profitable by systematic development. Three years ago a company at Chancerville, Sierra county, washed off in one year 15 claims of 100 ft. square each, average depth of gravel 12 ft.; this gives a little over 166,666 cubic yards, which yielded \$17,000. Water cost, \$10,000; labour, \$3000; profit, \$4000; \$17,000, about 10c per cubic yard.

This work was done with 500 in. of water, 150 ft. pressure, Craig's globe-joint, throwing 5½ in. stream, tail-flume 4½ ft. wide. At Smartsville the upper strata, to a depth of about 120 ft., paid 48c per yard; the 80 ft. next below 84c, while the bottom strata paid much more.—San Francisco, Nov. 20.

#### GAULEY-KANAWHA COAL COMPANY.

SIR.—When the prospectus of the above company reached this place I addressed you a letter, signed "Carbon," in which I exposed grave discrepancies between the actual facts concerning the property and the statements in the prospectus, but I admitted that all the statements as to the amount of coal in the property were true; although I stated, among other things, that the price paid for the property was extravagantly high. I expressly stated in my letter that I thought the vendor had not intended to deceive, but had taken matters of accessibility, navigation of the Gauley river, &c., for granted. I had no interest, whatever, in the matter, except to prevent a disastrous failure on the part of the first English company operating here, which would bring this region into discredit in London. I knew very well that after my letter the directors would not dare expend money on the Gauley property until the facts had been fully investigated, and I knew that when this investigation was had the shareholders would find I had spoken truly. I have, to-day, your paper of November 1, containing a report of the statutory meeting of the company, with copious remarks of Prof. Ansted, and the Chairman, Mr. Shakspear, the two directors who retorted so violently upon my letter. I said absolutely nothing against the property, except that it could not at present be worked, and that the price paid for it was too high.

Now, Prof. Ansted's report was read at the meeting. He recommends not doing anything with the Gauley property until the railway to run by it is finished. He does not come square up to the fact that the Gauley is not now navigable at any season of the year, but admits it was not navigable when he visited it. When we remember that in the prospectus which bore his name it was stated roundly and distinctly that "the Gauley is navigable for barges at all seasons of the year," we can see how difficult it may have been for him to make a greater retraction. But I still insist that the Gauley river is not, and never has been, navigable at any season of the year for barges, or anything else, except to shoot logs down in time of high water.

The Chairman, in summarising Prof. Ansted's report, says he advises that the Gauley property "be let alone for the present, which is what I said in my first communication. Now, as to the second objection I made, that the price was too high. This same report shows that the company having merely determined to "let the Gau-

le property alone for the present," cast about them to find some other property out of which they could make good their promises to the shareholders. They found and bought the Tyree property, a tract of about the same size as the Gauley property, with better deposits of coal in it, and in a splendid position for working. It is worth, acre for acre, considering situation, &c., probably five times as much as the Gauley property. For the Gauley property they are said to have paid 30,000£ in fully paid-up shares. For the Tyree property, so much more valuable, what do they pay? 1500£ in shares, and 1500£ in cash—about one-tenth of what they paid for the inaccessible Gauley property, which they now think had better be "let alone for the present."

My only object, Sir, in writing this letter, is to vindicate my veracity as a correspondent. I have none but the best of feelings for the Gauley-Kanawha Company. I hope it may have a grand success, and I sincerely believe it will, if it confines its operations to the Tyree property, and continues in its good resolution to "let the Gauley property alone for the present."

Charleston, Kanawha Co., W. Va., Nov. 20.

#### SILVER IN COPPER ORES.

SIR.—It will be remembered that the present discussion originated in a statement by Mr. Barnard that the whole of the mineralised matter in all the lodes hitherto discovered in England would yield on an average 6 ozs. of silver per ton, and this statement is now supported by Mr. Bawden, who pledges his professional reputation on the correctness of Mr. Barnard's judgment. Without following the latter gentleman in his interminable round of rhodomontade I still venture to caution the public to be careful in forming any opinion like a sanguine opinion upon the subject until reliable experiments have been made by men of reputation and experience to prove whether copper ores generally do or do not actually contain the quantity of silver represented.

I happen to have lived long enough to remember the days of Malachi and Wheal Brothers, when almost within a stone-throw of the spot on which Mr. Barnard is now operating discoveries were reported upon which, according to common belief, would almost eclipse the riches of Peru. I also bear in mind the great Berdan excitement, when it was confidently asserted that nearly, if not all, the gossan in the West of England contained as many ounces of gold per ton as Mr. Barnard now says the lodes contain silver, the practical assayers being told then, as now, that they were ignorant of the proper mode of extraction. The upshot of this little delusion was that gold to the extent of something like 150,000£, was extracted from the pockets of the public, which shortly afterwards found its way across the Atlantic. These examples, with the recent failures of the King, Queen, and Virtuous Lady will, it is to be hoped, lead the public to exercise their judgment to some little extent before rushing into any more of these chimerical schemes.

The Tavistock district being undoubtedly an excellent one for mining enterprise, it is much to be regretted that its reputation should be so constantly darkened by schemes foisted on the public by parties of all trades and occupations, possessing not the slightest knowledge of even the commonest rudiments of practical mining. Incidentally the New Devon Consols Mine has been adverted to in the course of the present correspondence. Take, it is said, this mine as an example when last worked and compare it with the present system of working, and what is the result? Fairly considered the result would appear to be simply this:—Tin during the whole of the present working has realised a higher price than has probably ever before been known, and, notwithstanding all this good fortune, no dividends have as yet been paid; this being the case, the natural inference would seem to be that the company who worked the mine last would scarcely have been justified in erecting gigantic and enormously expensive works with the price of tin then at such a low ebb that Dolcoath and Tineroff, with their extraordinary returns, could scarcely keep the wolf from the door.

Dec. 9.

#### STEAM PUMPS AT THE VIENNA EXHIBITION.

SIR.—It would not be just to Baron Schwarz-Senborn to allow such a reflection as that contained in the postscript of Messrs. Hayward Tyler and Co.'s letter, which appeared in your Journal last week, to pass unnoticed. The attempt to magnify a specific award for "Feed Pumps" into an equality with the award made for the larger class of Direct-Acting Steam Pumps so widely and successfully introduced in this country by our firm, must not be permitted to subject the highest official of the Austrian Commission to the slightest suspicion of altering the jurors' award by adding words not embodied in the jurors' protocol. When Baron Schwarz-Senborn, under date Nov. 14 (three months after the jury had dispersed), expressly states that the International Jury of Class XIII. have, as a matter of fact, awarded the "Medal for Progress" to the firm of Tangye Brothers and Holman, for steam-engines and pumps. We submit that he speaks with the greatest possible authority, under a full representation of the mischievous nature and purport of contrivances announcements ostentatiously published and withdrawn under reflections of a serious character. We beg the insertion of this, with the appended copy of letter in reply, in your next issue.

Dec. 9.

TANGYE BROTHERS AND HOLMAN.

(Copy.)

DEAR SIR.—Replying to your esteemed letter of this date, we find we inadvertently omitted to date our letter of yesterday. We avail ourselves of this opportunity to be equally frank in our assurance that we regret any cause or possibility of annoyance has occurred between firms reciprocating trade relations. We submit, however, that you adopted a course unwarranted "in self-defence." Baron Schwarz-Senborn has added nothing to our award by saying "and Pumps," as the words "Progress in the construction of Pumps," are recorded in the Protocol of the International Jury. We do not know if we rightly attribute your award to be the result of your lending a "Feed Pump" to the Commissioners, if so, it was possibly an award of courtesy. In any case, we think we can justify our claim by amply compiled statistics to the highest award given, even a higher award than that granted us.—Nov. 27.

Messrs. Hayward Tyler and Co., 85, Whitecross-street, London, E.C.

#### MINING BY MACHINERY.

SIR.—I have noticed Mr. McKean's courteous reply to my remarks concerning his rock-drill, contained in my paper "On Mining by Machinery," and if I have made any mistake in my statements I will be very glad to acknowledge such errors. Mr. McKean in his advertisements pointedly calls attention to the fact that his machine strikes from 500 to 1000 blows per minute, and even "1200 counted by machinery," and when I saw the machine at work I was struck, and almost frightened, by the astonishing rapidity of its strokes, and the number was too great to be at all reckoned. I have, therefore, only taken Mr. McKean at his own word when I said that the machine worked with what I still consider an excessive and destructive velocity. I shall be very glad to see the machine working at 15 lbs., but I am under the impression that it would not be effective with that pressure.

I gladly repeat my former statement, to the effect that I consider Mr. McKean's machine as very superior to all other machines now in the field, excepting the Dubois Francois Anti-concussion machine, and Mr. E. Edwards's Excelsior, with which, however, I think it can well compete.

I cannot, however, admit that there is no blow or concussion in the working of Mr. McKean's machine, as the steam-valve, which takes the form of a cock, is moved alternatively by the blows delivered on suitable levers or cams by a peculiar swelling of the back rod of the piston, and when I consider that when working at (say) 1000 strokes per minute, these levers, the rod on which they are attached, and the valve they work, receive 2000 distinct blows or impulses per minute, I cannot help being afraid of the consequences. I have not had till now the pleasure of finding Mr. McKean's machine at work in the mining localities I have lately visited, but this may be owing to my want of chance, or to the fact that Mr. McKean had only begun last year to introduce his machines in England. But I entirely concur in his remarks that the great point in a rock-drill is not absolutely the number of inches it can bore per minute, but the result of its continual and practical use in mines or drifts where the real working qualities, as regards liability to breakage and wear, are sure to reveal themselves, and to tell on the progress made.

I cannot, however, agree with Mr. McKean that a public series of

experiments would decide fairly the merits of the various drills, as the trials could only be of short duration, the machines sent would not probably be a fair average of the make, and, finally, they would most likely be worked by special men well accustomed to show them off. I would, however, take part in the fray should ever this scheme of competition be realised, but I would much rather trust to the slow, but sure, judgment of the mining public from actual practice in the shafts or drifts. I beg to end this rather long letter by the following figures, extracted from Mr. Daxhelet's book, engineer to Messrs. John Cockerill and Co.'s works, in Belgium, and relative to the Anti-concussion drill's performance, and I have no doubt Mr. McKean will be able to favour your readers with some similar statements respecting work done by his machine of an equally independent, authentic, and satisfactory character.

CHAS. BALL,  
21, New Bridge-street, Blackfriars, London, E.C., Dec. 10.

Extract from the *Revue Universelle des Mines*:—"The Société Civile de Ronchamp, Haute Saône, France, has cut a level of 7 ft. 6 in. by 7 ft. 8 in. in the Ehoulet Pit. The rock was one-fifth very hard compact sandstone, two-fifths of ordinary hard sandstone, and two-fifths of hard shale. By hand the progress had been about 23 ft. per month, the section of adit being only four-fifths of the machine-cut adit, and the cost was 37. 2s. 6d. per yard forward, or about 14s. 6d. per cubic yard. By the use of the Anti-concussion machine, from Jan. 1, 1872, to May 15 following, the progress was 237 yards, or 53 yards per month, or 159 feet of large adit by machine as compared with 23 feet of small adit by hand."

#### MINING BY MACHINERY.

SIR.—"If you have no case abuse defendant's attorney." According to this well-known rule, if one man says your rock drill has a small area of piston, and it happens to be true, retort at once that you have legal proceedings going on with this man, and that you will not open a controversy on the merits of machinery until pending suits are settled. If it does not enlarge the area of your piston, it will relieve you from an embarrassing answer, and behind the screen of guarded insinuation you may still reflect some annoyance on your adversary, without committing yourself to any positive fact. Such is the safe, but unfair, and certainly un-English, way in which Mr. Brown meets my very mild technical remarks on the drill invented by Mr. Chas. Burleigh.

I will only add, in a few words, that I have never been in the employ of Mr. Brown, and that he never paid me a penny of salary, and that being equally indifferent to his drills, suits, charges, remarks, and other things, *equidem forme*, I will take no further notice of any other libellous remarks he may choose to print, and leave him to settle with his conscience and my solicitors.

21, New Bridge-street, Dec. 11. C. BALL.

#### MINERS' CONVERSATIONS—No. VIII.

John.—In New Great Consols I find they have had a great many "lets," and the expense in laying out the works at surface has been very heavy in calciners, dressing-floors, &c., which is the reason for its present non-dividend state. I have seen a miner who works there, and he speaks most hopefully of the mine.

Bill.—Is it true, which I heard, that that mine and West Great Consols are to be united, and become one concern?

John.—The miner says that he understood it was a *probable* event, but not quite certain, because it will depend upon the will of the majorities in the two companies. Meetings are to be held shortly, when the decision will be announced.

Bill.—Upon what ground is such a union considered desirable?

John.—On the ground of *economy* in the dressing and calcining appliances. New Great Consols Company have expended an immense sum in calciners, flues for arsenic, &c., which can be made available for both mines, so the miner says.

Bill.—Shall we ever hear the last about the Red River; it is referred to in nearly every number of the *Mining Journal*, and it has been attempted to prove that because the mine agents at some of the mines are concerned in the streaming on that river, they are guilty of stealing tin—in other words, of sending it down the stream that they may catch it for themselves! The folly of such a supposition is manifest when we remember that the agents could not have it till after it has passed through the works of several other people, who are not agents. Is it likely that the mine agents would send down the tin with so slight a prospect of advantage?

John.—I tell you what I think about this matter. I believe that no agent is either R or F big enough intentionally to send down the tin; but I believe that it is done from want of proper attention to the means of prevention. I have no doubt, ere long, an investigation will be made of this subject, with a view to the retention of the tin at the mines, keeping it from the river. But the quantity carried down has been so diminished of late that some of the streamers or "squatters," as Ennor calls them, find the pursuit attended with a loss. There are too many on the stream for all to gain by working there. At first a good profit was made by Captain Perry and others, but that has fallen off considerably since public attention has been drawn to the subject through the *Mining Journal*. Of course the adventurers are desirous of avoiding the loss of their tin.

Bill.—Mining has been described by some as an investment to be avoided like the plague, and by others as a pursuit to ensure wealth. Can you name many who have gained much by mining?

John.—Yes: Messrs. Williams and Co., of Scourier, made hundreds of thousands by mining. I heard that in two years they gained 200,000£. Mining was the foundation of their colossal wealth, for they are, doubtless, the wealthiest family by far in the West of England. They did not, I know, make it *all* by mining. They are merchants, smelters, &c. No one in Cornwall has an income so large as that of Mr. J. M. Williams. It has been stated that in seven or eight years he has laid out 700,000£ in lands, in addition to the large property he possessed before. Sir F. M. Williams is also very rich, also Mr. George Williams; his brother, Mr. Michael Henry Williams; and Mr. Williams, of Flushing (grandson of the late Mr. Michael Williams, of Trevice). Mr. J. C. Lanyon left a large property made by mining; Mr. J. P. Magor, Mr. B. Simpson, and scores of others. I know that some have been ruined by mining, but those persons in general were unwise, not considering the extent of their purse, or not careful in their selection of mines. Some persons take a heavy stake in *one* mine, excluding their ability to invest in any other, whereas they ought to take shares in *many* mines, thereby having a better chance of success. All mines undeveloped must be speculative; I would, therefore, distribute the risk over a large area, so to speak.

Bill.—Did you know the old Capt. Thos. Teague?

John.—Yes, very well; for very many years he was one of the greatest speculators. He put to work many mines, but the great prize of his was Tresavean, where he gained immensely, but most of what he gained there was wasted in other mines, of which he had too many. Such is the thirst for gain in the heart of worldly men that they are never so satisfied as to say at any time, "It is enough." Capt. Teague, owing to his over speculation, left but little property at his death. Capt. Joseph Lyle was another great mine projector. He left about 45,000£, but it is said to be all dispersed. The money and lands left by Mr. B. Sampson were bequeathed to a lawyer. The present "great gun" is Capt. Teague; not one of all I have named became rich so quickly as he. Whether his wealth will be handed down to posterity or spent in the present generation time will show.

Bill.—I heard a funny story some years ago about Capt. Thomas Teague.

John.—What was it?

Bill.—Owing to his having so many mines to keep on money was sometimes very long withheld from the merchants. There was one merchant who hit upon an expedient to get his money, and this was it. He knew that on a certain day Capt. Teague was going to pay at one of his mines, for which, of course, money must have been provided. The merchant went early in the day to see him. He did so, and said, "I am come to be paid my bill." "You can't have it to-day," said Capt. Teague; "but I *must*," said the merchant, "and I shall not leave before I have it." "I tell you you can't have it now," said Capt. T.—"Then I will wait till I can; I have a night-cap in my pocket!" Pressed so hard, Capt. T.—after a while said, "Mr. R.—how little will satisfy you for the day? If I give you a draft for the balance—will 100£?" "Yes," said Mr. R.—"The 100£ was instantly paid, and the draft for the residue handed over. This event was prior to the discovery of the wealth at Tresavean."



**John.**—That anecdote reminds me of another—very similar indeed, and with a similar result. A person in this town (now deceased) was owed a sum of money by a gentleman near Penzance, and at a time when he really wanted the money he called at the debtor's residence for it. "The house and every arrangement connected therewith were splendid. 'I have taken the liberty, Sir,' said the creditor, 'to wait on you for the amount due to me.' 'You must call another time for it,' said the gentleman, 'you cannot have it to-day,' and hastily walked out of the room, thinking, I suppose, that the poor man would quickly leave. Not so, however; he resumed his seat. After a little while, finding, probably from a servant, that the man was still there, he came in again, and said, 'Why are you waiting?' I told you that you could not have the money to-day." "I am very sorry, Sir, to trouble you, but I am in want of the money, or I would not have called." "Well, you cannot have it to-day," said the gentleman, and left again. The man resumed his seat again. In half-an-hour back came the gentleman, and said, "What! are you here still?" "Yes, Sir," said the man, "I cannot go home without the money; I want it." "You are the most stubborn fellow I ever saw. I suppose I must give you a cheque to send you away," and, accordingly, he went into another room, and brought out a cheque for the amount demanded.

**Bill.**—I never heard of two cases more alike. They show what perseverance will effect.—*St. Just, Dec. 9.*

AGENT.

#### N. ENNOR'S ADVICE TO MEN INCLINED TO SPECULATE IN ENGLISH MINES, AND HOW TO GET INTO THOSE MINES ALREADY ON THE MARKET.

**SIR.**—As this is a subject upon which many require advice I would say—First: Be on your guard against every highly-coloured report, and particularly with those that promise an early dividend. Then notice every mine that attempts to pay dividends out of called-up capital. These mines in 15 cases out of 20 are bad, and the promoters such as mine speculators should avoid, both they and the board of directors; pay no attention to their names, they are usually needy men, and have no money to spend. Enquire—Do they hold only free shares? how many paid-up shares? If only free shares they are unfit for directors; their motive is only to get the fees. They are always to be seen at a mine meeting, and will use every effort to make you believe them as to the high opinion they have of the mine, and often go so far as to tell those present they have seen it themselves. Suppose he or they had been in the mine, what did they know as to its prospects? He is ready to meet anyone that may question him. He is also ready with a Captain Jack to bear him out. I remember going to report once on a mine in Devon; when I came there Capt. Jack could not go into the mine with me, as he had an admirer, a great shareholder, to attend to. I said it did not affect me. I came there to see and report on the mine, and I must see it. He said he could not go down into the mine with me. I went to this mighty great man that Capt. Jack stood so much in fear of, and asked him what interest he held in the mine? He hesitated a little, and then said "Not any."

Then I asked him why he detained the captain? He said that he only wanted to question him as to the mine's prospect. I said, "In that case you had better wait, as I am called in to give a general report, and I want the captain to show me down." He said, "He was down the day previous." Then I said, "You need not question the captain much; it's all but a new mine," when he gave up. The admiral, when I was about to go into the mine, said, "I wish to call your attention to a great slide in the mine that will be the means of producing immense masses of copper if properly worked." I said no more, but went underground with Capt. Jack, but I could find no such copper lode or slide as this would be knowing one referred me to. I found only an old flat tin lode dipping north at an angle of 45°, with the shaft sunk over its back.

On my return to the surface I found the said admiral still at the office. His first question was, "How do you like the slide and lode?" I said, "Will you answer me the question I ask you first? Who told you that a slide was there?" He said he saw it himself. "Then," I said, "you have far better sight than I have. I can see no slide or copper lode in the mine, neither did I believe anyone else could see either;" but I was quite ready to go down again if he could show me a slide, as I had seen none, and Capt. Jack had failed to point it out to me. He called on Capt. Jack to know if there was not a slide in the mine, when Capt. Jack faltered a little, and said he did not understand him. He thought what he alluded to was the flat lode. He, the admiral, would not go down again. I then had him in my own hands, not as an admiral but as once a pay clerk in some foreign mine, and he had through a friend got a Government coal surveyor's post. I made him admit he was never in a metallic mine before. Had I not crossed him he would have sent on a flaming report, and had Capt. Jack to sanction it. As it was he sent no report, but wrote to say that he quite agreed with my views. This is the class of men used to get up unreliable reports; these are often written by mine promoters themselves, and put in those men's hands with orders to write the report as near as they possibly can to it. These men, or mine reporters, know little or nothing of mining; they are only men employed to write what will suit brokers; they know not a single law of the earth's layers, or what they grow, indeed they never knew a single law of nature.

The man who purchases shares in mines on such reports must know that the reports cannot, or should not, be looked upon as his guide as to where ore grows in quantity in the earth, or what produces it. I say never purchase in mines that circulate these reports. If you go into new mines from reports, they should be from men of known standing, men that have found a paying mine. A man to purchase mine shares to hold should ever be watching mining companies' actions for some time. When he has made up his mind as to what mine he thought would give him the best chance to invest in, then purchase one share if selling high; if low, to the amount of 20l. or 40l.; then give the purser notice he was a shareholder in the mine, and wants to see the books; take care your name is entered in the book. When you overhaul the books take care to be satisfied with what time the coal bill and every material was charged up, and that all coals, pumps, engines, timber, iron, candles, ropes, &c., are charged up to one month. I will suppose you found these things apparently all right. Then see the receipts; then see when the last tin was sold, and to what amount. Then see the amount of the smelters' tin bills and the dates; then ask the depth of the mine, and what dues are paid; when paid up to; see the receipt. Ask what machinery they require to carry on the operations of the mine. On what terms have you to come in the mine? What salaries are paid to agents, and what is the count-house expenses? Have you any other book debts? if so, to what amount. The prospect, and what is the reserve of ore are not in his department? Get that from agents, let them answer to those points, and enter those things in a book you keep on purpose. If this were generally carried out, mines would soon show in a different light; no six months' bill would be left back by those who cook accounts to make dividends to raise the price of shares; it is this that enables the account cookers to sell out. Then tell the manager you thought the mine might be a fair speculation, and you thought of purchasing in the mine very largely, but should do so subject to what he had shown you as to the books being correct, with no other book debts to the amount of 500l. hinting that you had not a doubt of it, but he must hold you harmless as to any other debts. If it is all right, he will be open and candid, and readily say yes; if he elevates his shoulders, and says he cannot be responsible—any but little, and sell out what you have; those things must be done quietly until you see it is all right. Then you should enquire of the merchant if all the back bills are paid agreeably to what you saw in the mine books. Then see if the last sale of tin agree, and make sure if it has been delivered to his works. Notice the last bills of coal, as the latter ones may be entered and paid, and back ones not paid. Then see how the banking account stands. If a man really wishes to take an interest in the mine he must take some pains to get at the truth of how things stand. If shareholders did this it would soon put a stop to merchant, purser, and manager, and captain's cooking accounts in mass, as is said to be done.

My advice to all who venture to hold is to take up shares in young

and promising mines at the cheaper rate, and have no middle men as mine sellers; they are sure to use every effort to get up the price of shares. Not a single mine of this class is worked but to sell. Every dividend mine at work in the county should pay 6 per cent. interest for money and the first cost, till all the purchase money be paid, but few of them are worth seven years' purchase. I could refer to one of the best mines, and I think the best managed, in the county which is only paying 4 per cent. Then, how and when are they to get back the purchase money (500l.), it only paying interest? Then, they are paying nothing towards the purchase money, nor will not without a rise in tin. When will that be, in fact? Ask if such a mine is worth ten years' interest at 20l.? See the risk a man runs to recover what he pays for a share in the mine. Then, this is a deep mine.

I next notice another mine, which is up to its value if it pays only 8l. per year; 6l. of this is interest of money, as it sells for about 1000l. It pays 2l. per year to meet the first cost, or 50 years to get the money back. Then its value should only be (say) 10 years, or 20l., is quite enough. I may ask what take have they, and who will insure it in more than that? Who will show me five mines in the county doing better, or worth more? It seems to me the high price of shares is improperly kept up, but I take care no one will catch me to invest in mine shares at those prices. Not a man that purchased in mines at the present price ever gets his money back again, but the first finders. Devon Consols shares have been sold at over 800l. each, and it paid about 1016l. a share, but whoever received it but a few of the first finders, who held on? South Caradon paid 700l. odd; I have not its former selling price, but say it sold for 500l. only 10 years back. Then who has got their money back with 6 per cent. interest? All mines should pay that interest on purchase-money. Then the interest of the money should be 6 per cent. for 10 years (3000l.) only. Then what dividends has it paid in the 10 years? not 500l. a year. This is one of the very best mines. I cannot see how anyone can make any money by the purchases. Will some one tell us how much he has made by his share over the purchase-money, he deducting 6 per cent. interest? Were we to look through all the list of dividend-paying mines it will be seen that the first money paid up on the majority of them is trifling; the bulk was chiefly young mines cut rich shale, which shows that it is young mines that should be looked for, and they are only to be found by taking new sets, and trenching them.

All old, poor, dry lodes should be abandoned; they are the drawbacks. I notice all purchasers of mine shares are minus a large portion of their money through the purchasing of shares too high; it is the ruinous high price that shares are run up to that ruins the real shareholders; any honest practical man can give a list as to the value of every mine in the two counties, if he likes; then the genuine purchaser would stand something like a fair chance for what he pays out. I may fairly ask what mines are to be found in the whole list of call-paying mines, 50 fms. deep, worth more than the selling value of the materials? And then many of these are even dangerous to purchase, as nearly everyone of them have back debts.

N. ENNOR.

#### THE "ORIGINAL CORRESPONDENCE" IN THE "MINING JOURNAL."

**SIR.**—The Tin Fields of Queensland seem destined to be a trouble to our Cornish mines some time longer, according to the statement of returns by "Resident," which bears every impress of truth. Yet it does not appear that they are likely to continue to depress the price of tin to such an extent as at present, seeing that the exporters suffer a loss of from 5l. to 15l. per ton, as expressed by "Resident," upon all sold. Thus, while they have the richest deposits, and as time goes on, and as these richest spots become exhausted, the cost of production must become greater still. Mr. Robt. Adams gives us an account of Brown's Creek Gold Deposits, New South Wales. This appears to be a singular geological formation, and may be the result of volcanic action. This letter is well worthy of close attention, as in all our experience of, and acquaintance with, mineral formations we have not known a similar phenomenon as described. Would it be too much to ask your correspondent to kindly send you a rough sketch and a few specimens for the benefit of such of your readers as could call at your office for their examination? Mr. S. H. Newman gives us a wonderful account of the mineral riches of Arkansas, and indicates a very strong desire for the investment of more English capital. Mr. Percival Stockman describes some of the mines in Colorado, which we suppose also require English capital for their development. Now, we do not object to the employment of English capital fairly to the development of American mines, but we do object to the purchasing of salted claims. We object to paying too heavily in the shape of premiums on those mines, and would like to see invested capital returning a fair profit into the English pockets supplying it. We have no doubt this can be done; but in order to ensure it Englishmen must look well after their own affairs. There are practical and scientific geologists and miners in this country, of high standing and repute, of too much experience and acuteness to be easily imposed on, and too honourable to impose on others. Seeing this, we do think that American mining has not been so profitable to the capitalists of this country as it should have been, and as it may still be rendered by more appropriate arrangements.

Mr. Bawden supports his statement with regard to silver in copper ores, which was scarcely necessary, as his statement is generally known to be true by miners, smelters, and assayers, and Mr. Bawden having had a long experience in such matters few can misunderstand him.

Rock boring gentlemen do not seem to agree together very well, we suppose because their machines are so much alike. These letters, and that on "Steam Pumps at the Vienna Exhibition," we pass over until the best boring machine and the best pump is settled by practical test.

"Miners' Conversations," three letters, with Captain Richard Pryor in each of them; no one will any longer ask what they are written for. "Agent" says, "Good wine needs no bush," yet he is not content with setting up his own bush, but breaks down other people's bushes to make room for his own.

Mr. N. Ennor, according to his own account, is great in everything—as a quarryman, a miner, a geologist, machinist, civil, nautical, and military engineer, and a great author in embryo. We would wonder what he is not great in, had we not known the gentleman, and that his imagination is at least as powerful as his veracity. We believe that Old Treburgett was the only mine Mr. Ennor ever was the agent of, and that there he left most of the silver behind him. Had matters been as badly conducted there as at West Wheel Seton, as "C." represents, we think it would have been so stated at the meeting, as that would have supplied ample reason for the shareholders' present in the change of management proposed; the fact that they have been stated there we cannot now give much credence to. As to "West Seton Meeting, and Bearing a Bear," we do not suppose that Mr. J. Harris has any authority for stating what he does with regard to Mr. Basset's interference in the matter. We give Mr. Basset credit for too much good sense to interpose in any such way, and although we do not desire to see the proposed change here carried out, we should be very sorry to see that the lords intermeddled with the affairs properly of shareholders only.

The three letters on "Llanrwst Mine" seem to dispose of "Pedestrian" and his doubts. We do not see that, because "Pedestrian" invested in another mine, where an estimate of quantity of lead ore dwindled down from 200 tons to 12 tons, that it necessarily follows there must be a similar recurrence in Llanrwst. From Mr. Knapp's experience we think he knows his business better, but "Pedestrian" may have been deceived in appearances either way. Mr. Robert Knapp criticises our critiques of Nov. 22 and 29. We felt that he could give us more information respecting both granite at Trefrew and fossils at the mine, and do not regret having "goaded him on" to do so. We still think that a careful investigation of evidence before making statements as facts to be relied on, instead of tending to narrow to too great an extent the area of human knowledge, would have a quite contrary effect; not only so, but that such a course is imperatively necessary to the advancement of science. Moreover, our strictures were not directed against Mr. Knapp more than against his opponent, who, if any cause of grievance there be, ought to feel equally aggrieved.

"A Waiting Shareholder" takes what we consider a fair view of "American Mining," our views having been already expressed.

"A Shareholder," writing on "Richmond Consolidated Mining Company," starts his calculations on what may, after all, be false premises, and, if so, must lead to incorrect deductions. We do not see why, however, the directors should withhold from shareholders the information sought.

Mr. E. Bettelley endeavours to push Furze Hill Tin Mine more prominently before the public, but we are not acquainted with its present prospects.

"Iota" seems to us to advocate the proper step with regard to the Fortescue Tin Mining Company. We think that withholding information cannot advance the interest of shareholders. Turning to the Mossdale Lead Mining Company, is it not a pity that so many are in the position described by "A Constant Reader," who has, it seems, invested in a company which he is not sure has ever existed, and may, or ought he knows, be all a myth? If investors will not take more care of their money, how can they blame anyone? Surely "A Constant Reader" must know that the world is not made up of all honourable men, who would not under any circumstances appropriate what is not their own. People ought to deal honestly with all men, we know, but that may not be quite as well known. We think your correspondent's best course is to take care he is not so coolly done out of his money in future.

Mr. Barnard is still in the realms of wonder. If he could only realise what he proposes he would not need to "pause for a reply," but will win back the confidence he has now so nearly lost.

The strictures on the Brynn Mine, whether just or not, come with a bad grace from Messrs. Parkyn and Co., who, if we mistake not, have reported equally great discoveries in mines under their management, and have not yet affected the tin market much by their sales of tin. We have no particular objection to Mr. Parkyn throwing stones at others, but he should be sure that he protects his own glass houses.

We would still direct the attention of the general reader and the student of science to Professor Guthrie's lectures on "Heat," now being regularly published in the *Mining Journal*. These valuable lectures not only afford pleasure and instruction to the votary of science, but must be, in their large number of practical experiments, useful and interesting to the general reader, teaching him how to

overcome many difficulties, and showing him how in many cases so-called "accidents" may be avoided by a more careful observance of natural laws.

READERS OF THE "MINING JOURNAL."

#### WEST WHEEL SETON, AND ITS MANAGEMENT.

**SIR.**—Before a man rushes into print he should carefully study his subject, and be certain his information is correct. He should also be studiously careful to give the unperturbed truth, knowing that the truth perverted is worse than falsehood, and does infinitely more injury than the truth itself, however injurious the truth may be to those concerned. Without the slightest desire to rush into print, I am now instigated to the act from a love of truth and justice. On this double plea, Sir, would you kindly allow me a place in your valuable Journal for the following facts?

In last week's Journal a letter signed "C." appeared, respecting "West Wheel Seton, and its Management;" or, as "C's" letter implies, "mis-management," in which he has made especial reference to the apparent ridiculous waste on the Red River, and alludes to West Seton as contributing to those behind about 40 or 50 per cent. of their returns. Without the slightest intention of going into the matter of West Wheel Seton, or of what may or may not be done there, I simply appear to give your readers the plain, unvarnished facts which "C." perverts respecting the vexed question of waste of tin. "C." says one would imagine that immediately behind Dolcoath Mine, the "fountain head" of the river, and the beginning of the works on that river, the most tin would be returned, whereas immediately behind West Seton Mine is the spot where the largest returns are made. Now, Sir, in this statement of your correspondent, "C.," lies the perversion which would lead a casual observer from the real truth, and make the waste from West Seton appear most monstrous. When you have the facts from one who knows the river this seeming monstrosity of waste will be reduced even to "C's" absurd discomfiture—in fact, compared to "C's" version, the waste of West Seton will be (if, Sir, you will allow the comparison) no more than "a flea on an elephant's back."

In the first place, Dolcoath is not the "fountain head." Were it so, what has become of South Wheel Frances, West Basset, and West Frances, three mines returning about 70 tons of tin monthly between them? After these comes Dolcoath and Cook's Kitchen, opposite each other, and returning about 150 tons or more monthly. Next follows North Roskear, and opposite this Wheel Crofty, or North Crofty (I forget which), whose returns of tin combined amount to 35 or 40 tons monthly. Then follows Wheel Seton, and opposite East Pool; these two combined returning another 40 tons or more. Nine large mines, returning nearly eight times as much tin monthly as West Wheel Seton does quarterly, all join in confluence in this one river previous to West Wheel Seton confluence. From "C's" letter, Sir, you perhaps would imagine Dolcoath would be first, and the next and only other mine that washes its refuse down this stream would be West Wheel Seton. The facts above stated are sufficient disproof of such a wild statement. Now, Sir, immediately behind Dolcoath are some minor workings; immediately behind North Roskear and its opposite neighbour another lot of minor workings; and immediately behind East Pool and Wheel Seton a few more minor works; then comes West Wheel Seton, and the extraordinary returns which "C." shows up so monstrously in his erratic effusion.

Now, all the parties or companies who work on this river from above West Seton point of confluence work a part only of the stream coming down, and leave the other part to flow on uninterrupted in its course. It would be impossible in the space they have to work more than one-sixth of the stream, and in some cases not one-tenth, so you see there flows from all these mines, down to the point "C." marks out, from 80 to 99 per cent. of all the slime refuse of 300 tons of tin per month in one unbroken rush of water, besides the tin those companies in turn waste in their working, raising the whole to about 95 per cent., against which there flows in from West Wheel Seton the refuse from the small return of 13 tons per month, against 300 tons, truly in comparison like a "flea on an elephant's back." Now, Sir, I must give one more fact before I conclude. I have stated the works above West Seton confluence to be of minor consideration; look at the fact which follows. The company behind this point have spent a capital of thousands, and laid out works of immense magnitude, in fact, I may safely say three or four times the size of any other in the stream. They work instead of 10 to 16 per cent. of the mud, 50 or 60 per cent., and sometimes even more than this. Into this flows West Seton slime, just above the works, adding but little to the tremendous body of water in the river. So you see, Sir, it is the magnitude of the companies' works behind which allows them the greatest returns, and not, as "C." states, the confluence of slime from West Seton. "C." forgets that just below this the waste water from Carn Brea and Tincroft joins the same stream, and that there are several companies working on the stream behind these two mines.

Now, Sir, fearing I have already intruded too much on your valuable time and space, I will at once conclude by expressing the hope that when next "C." appears in print he will give "the truth, the whole truth, and nothing but the truth," which is invincible, whilst this sad perversion of "C's" is even worse than falsehood.

Dec. 10.

J. Z. W.

#### MINE MANAGEMENT—THE FIVE-WEEKS MONTH.

**SIR.**—The reviewer of the "Original Correspondence in the Mining Journal" was singularly unfortunate in the remarks he made on my letter in reference to the five-weeks month. Its adoption does not affect me in the least, and is not likely to; but this is a small matter compared with his other remark that the four-weeks pay is an unnatural thing. If he had said the occasional five weeks in connection with the four weeks was unnatural I could have understood it. I contend the five-weeks pay is unnatural, unreasonable, and unprofitable to mining. What is there in connection with the mines of Cornwall which requires such an arrangement? Nothing! Mines of every kind and works of every description out of Cornwall pay every week or every two weeks, and what is there in the least unnatural in it? If the Cornish five weeks is natural, why, then, all who pay otherwise are doing an unnatural thing. But that is not the point. Does the five-weeks month benefit mining or does it not? I contend it does not benefit mining, but is a positive infamy, and even if we descended to the two-weeks pay, as they have it in the coal and iron mines of the North, the mines of Cornwall would be still further benefited by it. But, to return to the fifth week, how much more do the agents allow for the five-weeks month than for the four, and how much more work is done? The establishment charges in mines are the same whether men work or play, and it is a fact well known to the agents that men do not work, nor will they, except in proportion to the pay; in fact, if you attempt to force men you will not get fair value for your money. What has brought into existence the numerous Trades' Unions, and the curse of any nation—strikes? Nothing but capital resisting labour instead of the two working in perfect harmony, and then, when labour gets the power it often makes unreasonable demands. I think it is politically admitted that those are the best statesmen of any nation who see the wants of the people and seek to supply them before a revolution forces it upon them, and well would it have been for England if her capitalists had adopted the same course. We should then have known little of strikes or Trades' Unions, and, more than this, we should not be, as we are now, compelled in many instances to pay more for labour than many trades, small or large, can legitimately afford, but it is just the result of the contest between capital and labour. Instead of capital and labour mutually labouring to promote the interest of our country it is quite a see-saw affair. When capital has the ascendancy labour cannot exist, and when labour is up it exacts all it can. What our mines require is the means to get the best return for the material and labour employed, and this, I contend, is only to be attained by giving a piece in sight, setting everything that can possibly be set, making up nothing to men who have not earned wages with a fair price, paying without deduction whatever the men have earned—little or much, never let it be known that above a certain amount cannot be charged if it is legitimately earned, and paying the men as often as possible. It would be a blessing for Cornish mines, Cornish miners, and above all, for outside adventurers in Cornish mines if mines were compelled to keep one week in hand and pay all bills as well as wages every four weeks. It would save a lot of trouble to the Stannaries Court, and misery to hundreds of poor miners. I speak from experience when I state there need be little trouble with Cornish miners if they have reasonable treatment, and the highest wages bring the best value for labour, and, whatever your servants think, make your five-weeks month general in Cornwall, and you will not be long before you have a miners' union here as well as in other parts.

C. P.

Perr, Cornwall, Dec. 9.

#### BRVNN MINE.

**SIR.**—With regard to Messrs. Parkyn and Co.'s remarks on this mine, they are easily accounted for, as well as the animus that has prompted them to it. Were they to display a little more practical ability in the prosecution of the mines under their charge, as we are told that immense deposits of tin are to be found on the properties, one of two things is apparent, either there is a want of ability to turn to practical account the minerals said to exist, or no such deposits have any existence—in fact, it would be satisfactory to learn which is the true version. If the power of making broad statements and inflated reports are evidence of ability to manage mines, Capt. Parkyn must possess ability in an eminent degree; but these qualities are not by all persons considered sufficient in themselves to satisfy those who have put out their money on the faith of the promises held out, and which



hitherto have not been fulfilled. Something in the shape of returns would now be more acceptable, for the time has pretty nearly arrived when some substantial evidence will be required, in order to pacify the expectations raised, and it is quite time for Messrs. Parkyn and Co. to correct the errors and mistakes (if they may be so denominated) into which they have fallen.

St. Stephen's, Grampound Road, Dec. 11.

MARTIN RICKARD.

#### ST. LAWRENCE AMALGAMATED MINING COMPANY.

Sir,—Everyone connected with mining in Flintshire will be glad to learn that this company is in so hopeful a condition as to have sold out during the last six months sufficient to have paid a dividend on the present issued capital at the rate of about 20 per cent. per annum, and it says a great deal for the prudent management of the concern that in place of paying that dividend, so as to get a place in the Dividend List of mining companies, the directors have had the good sense to lay the money out in improving and laying open the mines, as described in Capt. Wasley's report.

To my mind, there is a very strong and exceptional point with reference to these mines, and that is that the two parties who have the best means of judging of the capabilities of them show their confidence in the success of the undertaking—the one, the captain of the mines, actually preferring to take the whole of his remuneration in paid-up shares of the company; and the other, the vendor, taking his cash payment for the property out of the future profits. On enquiry, I find that the prospectus even understates this matter, as the arrangement is that of the profits only one-half is to go to the vendor until he is paid off, while the other half goes towards a dividend. I do not think any other mining company can show such favourable terms, or anything more calculated to give confidence to shareholders. Another very favourable feature is, the largest shareholder lives on the property, and acts gratuitously as purser, thus preventing the possibility of overcharges or other improper payments at the works. I have every confidence that the St. Lawrence, Victoria, and Valentine Amalgamated Mining Company will prove a good investment for its shareholders.—Dec. 8.

HOLTWELL.

#### NEW BRYNPOSTIG LEAD MINING COMPANY.

Sir,—In November, 1869, I purchased a few shares in this company. In June, 1871, I wrote to the secretary for information as to what was doing, not having heard anything up to that date. He replied that a meeting was shortly to be held, when the state of affairs would be laid before the shareholders. No statement came, so I again wrote to him about a year after, without receiving any reply. Since then I have heard nothing either by circular or otherwise. I do not doubt the total collapse of the concern, but I would ask if this is the way in which mining companies usually treat their shareholders? We are surely entitled to some general knowledge of the state of the mine. It is rather too cool to take the moneys of the shareholders, and for four years to send out no report whatever. Perhaps some of your readers can favour me with a little information, if the secretary or company will not do so.

A. G.

#### THE POSITION AND PROSPECTS OF WHEAL TREGGOS.

Sir,—In the Mining Journal of Nov. 29 I wrote a letter on the present and future prospects of the Treggos Common Tin Mine. I have to add to my last letter that there has been discovered in the Cornwall Minerals Railway cutting, which adjoins the boundary of the Treggos Common, a tin lode which, where cut into, is very productive for tin, and is without doubt one of the Treggos Common lodes. This will further enhance the value of the Treggos Mine, and tends to prove that lodes can be discovered by shallow workings, such as costeaning and trial shafts, before going to enormous expense in erecting machinery, &c., on the mere speculation of finding lodes with ore in them. The lodes opened upon in this mine fully warrant and justify the erection of stamping machinery, and it will then prove a bonum for mine to all concerned.—Roche St. Austell, Dec. 11.

S. K. COCKS.

[For remainder of Original Correspondence, see to-day's Journal.]

#### THE CHANNEL TUNNEL.

The geological conditions affecting the construction of a tunnel between England and France formed the subject of a highly interesting paper read before the Institution of Civil Engineers, on Tuesday, by Mr. Joseph Prestwich, F.R.S. The writer reviewed the geological conditions of all the strata between Harwich and Hastings, on one side of the Channel, and between Ostend and St. Valéry on the other side, with a view to serve as data for any future projects of tunnelling, and to show in what direction enquiries should be made. The points considered were the lithological characters, dimensions, range, and probable depth of the several formations. The London clay at the mouth of the Thames was from 200 feet to 400 feet thick, while under Calais it was only 10 feet, at Dunkirk it exceeded 264 feet, and at Ostend it was 448 feet thick. He considered that a trough of London clay from 300 feet to 400 feet or more in thickness extended from the coast of Essex to the coast of France. Judging from the experience gained in the Tower Subway and the known impermeability and homogeneity of this formation, he saw no difficulty, from a merely geological point of view, in the construction of a tunnel, but there was a difficulty in the extreme distance, the nearest suitable points being 80 miles apart. The lower tertiary strata were too unimportant and too permeable for tunnel work. The chalk in this area was from 400 ft. to 1000 ft. thick; the upper beds were soft and permeable, but the lower beds were so argillaceous and compact as to be comparatively impermeable; in fact, in the Hainaut coal fields they effectually shut out the water of the water-bearing tertiary strata from the underlying coal measures. Still, the author did not consider even the lower chalk suited for tunnel work, owing to its liability to fissures, imperfect impermeability, and exposure in the Channel. The gault was homogeneous and impermeable, but near Folkestone it was only 130 ft. thick, reduced to 40 ft. at Wissant, so that a tunnel would hardly be feasible. The lower green sands, 200 ft. thick at Sandgate, thinned off to 50 or 60 ft. at Wissant, and were all far too permeable for any tunnel work. Again, the Wealdon strata, 1200 ft. thick in Kent, were reduced to a few unimportant rubby beds in the Boulonnais. To the Portland beds the same objection existed as to the lower green sands—both were water-bearing strata. The Kimmeridge clay was 500 ft. thick near Boulogne, and no doubt passed under the Channel; but in Kent it was covered by so great a thickness of Wealdon strata as to be almost inaccessible; at the same time it contained subordinate water-bearing beds. Still, the author was of opinion that in case of the not improbable diminution of the Portland beds, it might be questionable to carry a tunnel in by the Kimmeridge clay on the French coast, and out by the Wealdon beds on the English coast. The oolitic series presented conditions still less favourable, and the lower beds had been found to be water-bearing in a deep artesian well recently sunk near Boulogne. The experimental deep boring now in progress near Battle would throw much light on this part of the question.

The author then passed on to the consideration of the Palaeozoic series, to which his attention was more particularly directed while making investigations as a member of the Royal Commission on the probable range of the coal measures under the South-East of England. He showed that these rocks, which consisted of hard Silurian slates, Devonian and carboniferous limestone, and coal measures, together 12,000 ft. to 15,000 ft. thick, passed under the chalk in the North of France, outcropped in the Boulonnais, were again lost under newer formations near to the coast, and did not reappear until the neighbourhood of Freme and Wells was reached. Although not exposed on the surface, they had been encountered at a depth of 1032 ft. at Calais, 955 ft. at Ostend, 1026 ft. at Harwich, and 1114 ft. in London. They thus seemed to form a subterranean table-land of old rocks covered immediately by the chalk and tertiary strata. It was only at the southern flank of this old ridge that the Jurassic and Wealden series set in, and beneath these the Palaeozoic rocks rapidly descend to great depths. Near Boulogne these strata were already 1000 ft. thick, and at Hythe the author estimated their thickness might be that or more.

Supposing the strike of the coal measures and the other Palaeozoic rocks to be prolonged from their exposed area in the Boulonnais across the Channel, they would pass under the cretaceous strata somewhere in the neighbourhood of Folkestone, at a depth estimated by the author at about 300 feet, and near Dover at about 600 ft., or nearly at the depth at which they had been found under the chalk at Guines, near Calais, where they were 665 feet deep. These Palaeozoic strata were tilted at high angles; and on the original elevated area they were covered by horizontal cretaceous strata, the basement beds of which had filled up the interstices of the older rocks, as though with a liquid grouting. The overlying mass of gault and lower chalk also formed a barrier to the passage of water so effectual that the coal measures were worked easily under the very permeable tertiary and upper chalk of the North of France; and in the neighbourhood of Mons, notwithstanding a thickness of from 500 feet to 900 feet of strata charged with water, the lower chalk shut the water out so effectually that the coal measures were worked in perfect safety, and were found to be perfectly dry under 1200 ft. of thin strata combined. No part of the Straits exceeded 186 ft. in depth. The author, therefore, considered that it would be perfectly practicable, so far as safety from the influx of the sea water was concerned, to drive a tunnel through the Palaeozoic rocks under the Channel, between Blanc Nez and Dover, and he stated that galleries had actually been carried

in coal under less favourable circumstances for two miles under the sea near Whitehaven.

But while in the case of the London clay the distance seemed almost an insurmountable bar, here again the depth offered a formidable difficulty. As a collateral object to be attained, the author pointed to the great problem of the range of the coal measures from the neighbourhood of Calais in the direction of East Kent, which a tunnel in the Palaeozoic strata would help to solve. These were, according to the author, the main conditions which bore on the construction of a submarine tunnel between England and France. He was satisfied that, on geological grounds alone, it was in one case perfectly practicable, and in one or two others possibly so; but there were other considerations besides those of a geological nature, and whether or not they admitted of so favourable a solution was questionable. Granting the possibility of the work in a geological point of view, there were great and formidable engineering difficulties; but the vast progress made in engineering science during the last half-century led the author to imagine that they would not prove insurmountable if the necessity for such a work were to arise and the cost were not a bar. The discussion will be resumed on Tuesday next, and as the paper contains a vast amount of information which will permit of the question being handled with far more confidence than heretofore, it may be anticipated that the opinions elicited will prove more than ordinarily useful.

#### Lectures at the Royal School of Mines.

##### ON HEAT.

Prof. GUTHRIE's third lecture on the above subject was as follows:—We must now resume the chapter on Conduction; and let me first of all show the difference in the conducting powers of two metals—copper and iron. Here is a compound, composed from the middle to one end of copper, and the other portion of iron. To the under surface of the bar at definite intervals small ivory balls are attached by means of wax, three on the copper portion and three on the iron. The bar is now fairly heated in the middle, and the heat travels by conduction in both directions, but the copper, being the better conductor of the two, gets hotter for the same distance along, or for the same temperature further along the iron. As the wax melts the balls will fall off, and you will find that the balls attached to the copper portion will drop before those attached to the iron. Another experiment to prove indirectly the same fact is here: a wire composed of alternate pieces of silver and platinum is traversed by an electric current, and you see the silver remains dull and comparatively cool, while the platinum, which is no thicker than the silver, glows vividly. On referring to the table we find that taking the resistance of silver to the electric current as unity, platinum has a resistance of 9.22. Now, the resistances for heat and electricity run closely parallel, perhaps are identical, so that silver conducts heat much better than platinum, and on that account remains dull, while the platinum becomes heated and glows. Now we come to the conducting power of liquids, and here we find that a great and unbridged gap must be recognised between the conducting powers of solids for heat, and the conducting power of liquids, liquids being so far inferior that the two groups have not been yet satisfactorily linked together. To prove that liquids are bad conductors of heat, I will take some ice in this test tube, put a small fragment of copper on ice to keep it down, and then pour hot water on the top, and by means of the lamp I can show you that I can make the water in the top of the tube boil without the ice being melted. For a long time it was thought that liquids did not conduct liquids at all. There is some difficulty in determining the conductivity of liquids, because when a portion of the mass is heated it expands, and a rule and currents are set up in the liquid. Here is an instrument for measuring the conducting power of liquids; two conical vessels, base to base, with a space between them for containing a film of the liquid, scarcely an inch thick; the lower one is connected with an air thermometer; into the upper one hot water can be poured. Inasmuch as the liquid is treated at the top, there will be no convection, and the expansion of the air in the lower vessel is really due to heat which has travelled through the liquid. Water, which is such a remarkable liquid in all its physical properties, stands at the head of all liquids (except molten metals) in having the greatest conductivity. In this table of conductivities notice that those bodies which contain the greatest percentage of hydrogen are remarkable for their conductivity: they have little thermal resistance.

We now come to the conducting power of gases; that gases have a very small conducting power is familiar to us all in every-day life. We know that if we take a piece of silk and clothe ourselves with it, with closely fitting clothes, we find a certain warmth to the body. If we grease or oil the silk, so that it will stick quite close to our bodies, we find it is comparatively less suited for preserving the warmth of our bodies. Here is a fibrous mineral called asbestos, which I will lay upon my hand, and now a red-hot iron ball is placed upon it. The mineral contains air in the interstices between its fibres, and the heat is, as it were, entangled in this air, and my hand (which is sheltered from the radiation by this card-board screen) is comparatively little warmed. It was for a long time believed, and many eminent physicists believe it still, that there is no evidence of gases conducting heat at all; and yet certain experiments seem to show that they have this power, and in different degrees. The lightest of all known gases—hydrogen—is believed by those who maintain the latter view to have the greatest conducting power, whereas those who hold the opinion that gases do not really conduct heat ascribe the cooling power of hydrogen above that of other gases to the nimbleness of motion of its parts, and say it is due to convection. The balance of evidence appears to be in the former direction, and tends to establish a real conducting power amongst gases, and to show hydrogen has the greatest conductivity. Here are two wires rendered incandescent in air by the passage of an electric current through them. I will surround the glowing wires with a jar of hydrogen, and you see I quench the incandescence, showing clearly that hydrogen is a better conductor of heat than air. Certainly this experiment might be explained equally well according to the other view, but bearing in mind that the liquid, which has the greatest proportion of hydrogen, is the best conductor, and that hydrogen is put to all intents and purposes a metal, it seems that hydrogen has really a specific conducting power. Getting rid of convection is really the only thing which has prevented this question being definitely settled; as it stands at present it is a moot point. That air is a bad conductor is shown by the use of clothing, of double windows, by the warmth of fur, which keeps out the cold, as it is said, really which keeps in the heat of the body, and by the turban worn in hot countries, which keep out the heat of the sun from the head. The very fact that we Englishmen are so prone to the "chimney-pot" hat has its moral, no doubt, in the fact that our climate is so changeable, and that we have in the "chimney-pot" hat over our heads a large mass of air, which preserves the heat from the body, and cold winds and cold air do not occur in our atmosphere. No doubt that is at the root of the habit of our keeping to the much-abused "chimney-pot" hat.

We now come to the third method by which heat travels—convection. In this we can only take the two examples of liquids and gases, for the simple reason that the solid, so long as it remains a solid, cannot have any intermolecular motions of this kind. Since liquids expand, speaking generally, with heat, it is clear that a mass of hot liquid in the bosom of a cold liquid of the same kind will tend to rise, and so we find that if we heat a mass of liquid on one side, currents are established to and from that point, and may be traced by causing the water, or other liquid, to carry with it pieces of visible matter (pieces of paper for instance) of much the same density as itself. [By means of the lime light, the passage of the hot water upwards amongst the cold could be seen in the image of a glass cell of water projected on the screen, and especially when a coil of platinum wire in the centre of the liquid was heated by a current of electricity.] Nature presents us with phenomena on a large scale of this relation between hot and cold water. We find that the ocean is traversed by currents trending in our hemisphere in a somewhat north and south direction, inclining to the east. The great type of these currents we may take as the Gulf Stream. It is as absurd to talk about the commencement of the Gulf Stream as it is to talk about the commencement of an individual rubber band. There is a circulation throughout, and the motion is carried on continuously. The origin of the Gulf Stream, considered independently of other sources, has received various explanations. It has been said that the heat plus upon the equator, for the same unit of area more than at the poles, and that is the prime reason why the polar regions are colder than the equatorial. Then it is said that the earth at the equator gets more heated than at the poles, gives off its heat to the water, swells the water, and thus the water runs from the equator to the poles down a mountain. There is something illogical in this, because the swollen water is not heavier than the water below it was heated. Another explanation is referred to the prevailing winds, and possibly these may have a great influence. But I imagine there is over the Gulf Stream is to be looked for more at the poles than at the equator. When water freezes it gets lighter, a quantity of water freezing at the poles leaves behind the salt of the water, the ice itself being lifted partly out of the water, and thus below the ice there remains a quantity of brine at the same temperature as the ice at the moment of freezing, but denser. This heavy brine sinks and travels along the bottom of the ocean from the poles to the equator beneath the general surface of the water, and these surface currents, as the Gulf Stream, and a somewhat similar stream on the coast of Japan, are to be accounted for by the travelling of hot water from the equator to the poles to restore the balance. They are modified by the wind, guided by the general contour of the shores of the continent, but having a general direction like that of the great stream from the Gulf of Mexico to our own shores which modifies our climate so essentially.

With regard to the conduction of heat by gases, the whole system of ventilation depends upon the conductivity of heat by gases, and depends upon the elementary fact that all gases expand on heating, and, therefore, if a hot mass of gas is embedded in a cool mass of the same gas it has a tendency to rise. If you close rigidly the doors and all the cracks in the wood of a room, the chimney will smoke unless you have a distinct path for the cold air to supply the fire different from that taken by the hot air and the products of combustion. Here is a small candle enclosed in a bell jar with an opening at the top, if I merely place a chimney over the opening you will observe the candle burn dim and perhaps before the lecture is over the candle will go quite out. But now if I place this diaphragm in the chimney, we have two distinct passages, the one which the candle is nearest to being that for the ascent of hot air, the other for the descent of the cold air, as may be shown by bringing the smoke of smouldering brown paper near it. In this latter case the candle burns quite brightly.

We now come to a point which requires a considerable amount of abstract reasoning to see it clearly, and therefore I will introduce it to you by the simplest illustration. Here are three glass jars of different capacities for holding water (different diameters); suppose I fill all of them up to the same level, and then add a certain quantity, exactly equal in every case, to each of the three jars. I cause the level of the water in each to rise, but to different heights—highest, of course, in the narrowest vessel. The widest vessel in which the rise is least, we should say, the greatest capacity for water. Or if the water stood at the same height, and I abstracted an equal quantity from each jar, I should then have different levels; and again if I wish to raise or depress the levels equally, I must take out or add unequal quantities of water. The analogy you have to bear in mind is

that bodies have different capacities for heat. Let us consider that bodies have a capacity similar to that which these vessels have for water, and let us consider the temperature which a body has to be represented by the level of the water in the vessels. Here I take four balls of equal weight, one of each of the four metals—zinc, copper, iron, and bismuth. All are now heated to the same temperature—the temperature of this oil bath, about 136°C. Let us at once distinguish between temperature and quantity of heat; all these bodies have the same temperature, but they have very different quantities of heat; they are like the jars which contain the same time, and place them on a cake of wax, and after waiting a minute or two you see the copper and iron fall through pretty nearly together, the copper a little the first; the lead only melts its way about half through the cake; the bismuth sinks in even less than that. So, then, we see that equal quantities of the substances, although at the same temperature, contain different quantities of heat. This amount of heat is measured by taking some unit of heat, some fixed substance and some fixed quantity of that substance, and heating it through a fixed range of the thermometric scale, and considering the quantity of heat necessary for this as the unit of heat. We may take a gramme (about 15 grains) of water, the weight of a cubic centimetre at 0°C, and heat it to 1°C; the quantity of heat employed in raising the temperature of this mass of water 1° centigrade is the unit of heat. To raise 1000 grammes of water from 0°C to 1°C, we should require 1000 heat units, or to lower its temperature 1° we withdraw 1000 units; to raise the temperature 2° we employ 2000 units, and soon. And so if we could raise the temperature of 1 gramme 1000°C without its boiling, we should have raised it to 1000 heat units. And now we come across specific heat. When, in physics, one hears the term specific heat, one must not think of specific heat at all; it is merely a ratio, and therefore number; specific gravity stands in the same way. The specific heat of a body is the capacity of that body for heat, as compared with an equal weight of water. I take 1 lb. of cold water at 0°C, and plunge into it 1 lb. of Fe at 100°C, and shake them together for half a minute till both have acquired the same temperature. I now find the temperature is about 15°C.—that is, the pound of water has gained 15°; the iron has lost 85°—both having met, as it were, in their common centre of heat. The capacity for heat of these two bodies is, therefore, proportionally to the distance moved. Now, I take 1 lb. of water at 100°C, and plunge into it 1 lb. of iron at 0°C, and after shaking together find the temperature to be 80°C; the water has lost 20°; the iron gained 80°; the specific heat of iron from accurate experiments of this kind has been found to be .11. That you may not think the result is due to the larger bulk of the water, I will substitute in the tin cases turpentine instead of iron, and by means of the differential thermometer you see the mixture of hot water and cold turpentine is hotter than the cold water and hot turpentine, showing the superiority of water in its capacity for heat.

#### GEOLOGY OF THE CAPE OF GOOD HOPE.

In an interesting paper read before the Geological Society on the Geology of the Eastern Province of the Colony of the Cape of Good Hope, Mr. R. PINCHIN, C.E., gave the results of his observations on the geology of the above region. The two principal sections described were from Cape St. Francis across the Great Winterhoek and Langeberg ranges to the lacustrine Triassic rocks near Jansenville, and from Port Elizabeth to Somerset. The lowest rock in the first section is the quartzite of the Great Winterhoek, which is immediately overlain to the northwards by clay-shales and sandstones containing Devonian fossils. Beds with similar fossils occur at the Kromme river, Cape St. Francis, and near Uitenhage. A patch of horizontal secondary strata stretches west from the Damotoc river, overlying the Eonon conglomerate in the same way as the Jurassic strata of Uitenhage. The northern ranges, Langeberg, Klein Winterhoek, and Zuurbergen, are regarded by the author as formed of rocks belonging to the carboniferous series, although closely resembling those of the Great Winterhoek in lithological character, except that among them are found of the peculiar rock described by Bain as "claystone porphyry," by Wyley as a "trap conglomerate," by Tate as a "trap breccia," and by Atherstone as an "intrusive trap." Rubidge regarded it as a metamorphic rock; and this view is adopted by the author, who describes it as an underlying and overlying the clay-shales, which always separate it from the quartzite, and as passing imperceptibly into the clay-shales. The mottled sandstone, or Eonon rock, is referred by the author to the carboniferous series. The author also noticed the occurrence of Tertiary or recent rocks containing remains of Mollusca identical with species now living in the Tertiary seas, lying unconformably upon the Devonian, and conformably upon the secondary rocks at various places near the coast.

In the discussion which followed, Prof. Phillips remarked that he was struck by the manner in which our system and nomenclature was applicable to a country so remote as the Cape. He was inclined to question the metamorphism of the nodules and concretions in the clay-shales into granites, and commented on the supposed interstratification of the metamorphic rocks among unmetamorphosed rocks. The correlation of the rocks at the Cape with the Devonian and carboniferous rocks of Europe he thought most interesting, especially taking into account the distance between the two localities. Prof. Tennant made some remarks on the gratitude due to the first geological observers in South Africa, who had, by the discovery of the diamond fields, so materially added to the wealth of the colony. During the last month he had seen no less than 100,000 worth of diamonds brought over by three persons. At present some 20,000 persons were employed in the fields, and the diamonds were equal to any in the world. The trap rocks in South Africa were as various in their character as those in this country, and this variety might well lead to speculation as to their origin.

SIR WALTER RALEIGH'S "EL DORADO."—In a lecture at the Truro Institution, Dr. LE NEVE FOSTER gave an interesting sketch of his own experience of a trip to Guiana, the El Dorado country, for which he left England in September, 1868. After describing the appearances of the town, Nueva Providencia, the lecturer said—"The first day I was there I went to examine the different workings in the gold district, and found that at a depth of 12 feet the miners came upon gold. But it was not without difficulty that they managed to work the gold, and the labour of breaking the rocks, the miner has called in the aid of fire, and he never works a course which does not contain visible gold. Mr. Foster next commented on the rather rough process of purging the gold, and said that large quantities of that metal are lost through the process. The flourishing of the diggings are at Chili, and it was here that the largest nugget, weighing 15 lbs., was found close to the surface. Here it is that you hear the clear and beautiful notes of the miners' bird; the miners say it is never heard unless gold is found close by, and in this case they did not say so without reason. The work at Chili are the most extensive in the district, and are worked by means of shafts. These shafts are very numerous, though the earlier workings are not much used at present. After remaining at this place a few days, I went into the forest. There were some very fine trees, it is true; but to the general observer there was nothing peculiar. Snakes are far from common, and though I was in the forest several days I only saw four. The insects do not strike one as being beautiful; this is to be accounted for by the absence of flowers. Temperature 68° minimum, 92° maximum; fever is prevalent, especially in wet weather, and there are people who say the place is not fit for a dog to live in. The lecturer then came to the concluding part of his subject. Raleigh's account of his journey called forth a strong rebuke from the historian Hume, who said that it was the greatest lie ever attempted to be imposed upon mankind, no ridiculous were the tales Raleigh told of the richness of El Dorado. But the vindication of Raleigh has been most ample, and Schomburgk says he cannot doubt but that, if he had gone on, he would have found gold in quantities sufficient to render its working profitable. It cannot be said that treasure has been found there, so far as relates to the miner, and thus there is no reason to doubt Sir Walter Raleigh, who says, in the preface to his work, "I was resolved that gold must be found either in quartz or spar. Near unto one river I found a large ridge of bank, which I endeavoured to break, because there appeared by himself and everyone else who had visited the place. It must be remembered that the word 'spar' is still a name for quartz, in use among the miners in Devon and Cornwall, and Raleigh would naturally know the name of the mineral. The gold fields are four days' journey from the banks of the Orinoco, just as Raleigh was told by the old chieftain. He (the lecturer) trusted that he had brought before them evidence sufficient to prove that Raleigh was justified in asserting that it was a gold country. The truth has come to light too late to serve poor Raleigh, but there is some satisfaction in clearing the character of one of England's greatest men. He was great as a scholar, seaman, statesman, poet, philosopher, and may justly be regarded as the father of American colonisation. Besides a large map, the lecture was illustrated by a photographic view of river scenery, &c., and specimens of minerals. At the close of a vote of thanks, proposed by Dr. Barham, and seconded by Captain Bryant, was unanimously awarded the lecturer.

THE WRITING BALL.—Although this ingenious little instrument will not probably supersede ordinary letter writing, it cannot be questioned that if correspondence were carried on by its aid the annoyance of deciphering illegible manuscripts would be done away with; so that the inventor of the writing ball, or electric type writing apparatus—the Rev. Malling Hansen—is doubtless well entitled to the medal *pro litera et artibus* which he, as well as Mr. Jurgensen, of Copenhagen, the manufacturer, has just had conferred upon him by the Emperor of Austria, for the ingenuity and utility of the invention. The instrument consists of a half sphere of gun-metal, pierced with radial apertures to the number of 52, all converging to the centre. The sphere rests on a frame firmly fixed to a bed-plate. Portions of the frame can be removed to obtain access to the lower parts of the apparatus. Each of the holes in the half sphere or ball has a piston ground off horizontally at its bottom, upon which is engraved a letter or figure. When a piston has been pressed in, a spiral spring raises it when it has been released. These pistons, when pressed down, impinge upon a level writing plate, which can be moved through the centre of the writing ball. This table has four wheels running upon rails, which rails again are fixed to another movable frame. The plane of the movement of the lower frame is at right angles to that of the upper one. Beneath the upper table is fastened a rack gearing with a spur-wheel fixed on a spindle, upon which it slides by means of a feather and a groove. The spindle at its extremity carries a tooth-wheel and a pinion; the latter gears with a tooth-wheel on the fine spindle of an ordinary clock spring. Behind the tooth-wheel attached to the spindle are arranged two electro-magnets, the armature of which carries an escapement working into the tooth-wheel. The terminals are fixed into the bed-plate. A bell having a hammer moved by a peg on the scape-wheel is attached to the apparatus. The ball is half sphere, has a semi-spherical cover, which rests on the ball by insulating pieces of ebonite. Springs are so attached to this cover as to form a connection with one pole of the battery when a key or other views, the other pole of the battery being connected to the ball itself. Upon the writing table is arranged a kind of tympan to hold a sheet of white paper by its edges. Upon the white paper is laid a sheet of carbonized paper. On pressing one of the knobs the lower end of the piston impresses a type on the paper; the knob then touches the spring under it, whereby electrical contact is established. The electro-magnets then attract the



## Meetings of Public Companies.

## GREAT WHEAL VOR UNITED MINING COMPANY.

A general meeting of shareholders was held at the offices, Gresham House, on Thursday, Mr. DIVETT in the chair.

Mr. J. J. THURAN (the secretary) read the notice convening the meeting, and the minutes of the last were confirmed.

The report of the committee was read, as follows:—

Dec. 11.—The committee very much regret that they are unable to report any material improvement in the mine since the last quarterly meeting. Every effort has been made to carry on vigorously the development of the western ground, whilst at the same time the cost has been kept down as much as possible. This will be easily seen on reference to the earnings of the tinwork and tribute men. At the time of the last meeting we trusted that some reduction might take place in the price of coal, and that the price of tin would have been maintained; unfortunately, in neither case have our expectations been realised. The high price of coal has continued, while the tin market has been constantly dropping. The inevitable result has been that, instead of being able to lay before you a more favourable balance-sheet at this meeting, the balance against us has increased to 1375*l.*, being 1038*l.* in excess of the balance against us at the last meeting. The expectations of our agents with regard to the ground west of Edwards's shaft have not, so far, been realised, in consequence of the frequent recurrence or branches of cross-courses, by which the lode has always been disordered. In the 164, west of Edwards's, it was fully proved that we had at last got into clean ground; and although the lode had not proved rich it had always yielded tin, and from its appearance a substantial improvement might at any moment be expected. This, and other important points, will be fully detailed in the report of the agents. A correspondence has taken place with Mr. Stephens, Mr. Trelawny's representative, touching a reduction of dues, and the mine has been most carefully inspected at our request by Captain Josiah Thomas, Mr. Trelawny's toller, and manager of the Great Dolcoath Mine, whose report will be read to you. We are glad to be able to state that we have this morning received a letter from Mr. Stephens, conceding a reduction of dues from 1*l.* 18*s.* 11*d.* to 1*l.* 13*s.* 6*d.* from June last. On the publication of the audited accounts to Oct. 31 last, there was a balance in hand of ... £ 230 15 7

Since which date there has been received—

Tin sale in December	1294 15 5
Tin sale in November	1279 8 0
Tribute and royalty on tin sold from leavings	61 4 3
Return of overpaid income tax	93 4 6
Old materials sold, &c., at the mines	22 16 6 = £2082 3 3
And paid—Labour pay, four weeks, to Oct. 10	949 13 0
Labour pay, four weeks, to Nov. 8	977 9 3
Merchants' bills	259 2 8
Sundries, discount, postage, &c.	12 10 3 = 2198 14 9

Balance (cash and bills) £ 783 8 6  
The actual account stands this day as follows:—

LIABILITIES—Merchants' bills	£1838 18 11
Lord's dues, six months	462 7 1
Salaries, three months	86 0 0 = £2387 6 0
ASSETS—Cash balance in hand	758 8 6
Old materials sold	228 17 6 = 1012 6 0

Balance against the mines £1375 0 0  
The committee regret after the interval of 14 years, during which period a call has never been suggested, to bring the question before the shareholders; while feeling it our duty to do so, we are gratified in being able to refer to Mr. Stephens's letter, and to say how much we appreciate the encouragement offered on the part of Mr. Trelawny. The committee recommended a call of 5*s.* per share, and a resolution to that effect will be submitted to your consideration.

The report of the agents was read, as follows:—

Dec. 10.—We have driven the 184 about 2 fms. on the course of the branch we intersected west of the first limb of the cross-course, west of Edwards's shaft; the ground here is very hard, and the branch has not improved, therefore we decided on driving a little further south, which we are doing, and if we fail to find anything better we purpose suspending this level for the present, and sink the winze through from the level above, in which we have a regular and well-defined lode, worth from 10*l.* to 15*l.* per fathom. In the 174, driving west of Edwards's, we have lode and branches 2 ft. wide, worth 8*l.* per fm.; here we have had several small cross-courses to contend with, so that neither ground nor lode has been at all well defined, but in the present end both appear to be getting more settled, and we hope that in a fathom or two more driving it will be of greater value. In the 164, driving west of Edwards's, we have lode and branches 2 ft. wide, worth 12*l.* per fathom; here too we have passed through numerous small cross-courses, consequently we have had but very little settled ground, but it is satisfactory to note that whenever we have had a fathom or two of better defined ground we have had an improved lode, and as we are now getting a great distance from the main cross-course we may fairly expect to get out of the influence of the cross, and no doubt we shall have more productive ground. In a rise above this level, about 8 fms. behind the end, we have a lode 18 in. wide, worth 7*l.* per fathom. This rise is a great many fathoms west of the 152, and should it hold up productive we should be driving of the 152 to communicate with the rise, and then extend the level west. The slope in the back of the 174, west of the winze, just communicated from the 164, is on lode and branches 3 ft. wide, worth 12*l.* per fathom; price for stopping, 4*l.* per fathom. Our stopes east of Metal continue about the same value as for several months past—30*l.* per fathom on an average. Our tribute department has been a little declining, hence the returns for the past three months have been about 9 tons less than the previous quarter. Our pitwork and machinery throughout the mine are in good working condition. We have a little increase of water since the wet season has set in, consequently we are consuming more coal.—S. HARRIS, J. JAMES.

We have very carefully considered our present position and future prospects, and herewith give you our estimate of returns and cost for the coming three months:—Returns, 87 tons (say, at 88*l.*, 3876*l.*; mine cost for same period, 4878*l.*; to which add London expenses, and dues if any. With regard to the future, we can say but little more than we have been holding out for the last six months—that is, that our hopes and expectations are in the western ground, which, so far as seen, yields a little tin, but not enough to cover cost of such an expensive mine as ours, with the present prices of materials and tin, still we feel perfectly justified in recommending the company to expend a little more money to prove this long run of unexplored ground, which not only ourselves but I may say all mining people of the district express a high opinion of; it will not require a lot of money to satisfy us as to whether or not we are to have a productive mine there—say, if drive the 164 and 174 another 20 fathoms to me that would be a good trial, and if nothing better be found I could not advise spending more or going on, for by that time, in all probability, our stopes east of Metal will be pretty well exhausted, after which the returns could not be kept up from the western ground at its present value, however much we might have opened up. We are, as you know, paying on all the points westward with full pairs of men, and we see no advantage to be got by spending more money monthly in that direction than we are now doing. It cannot be forgotten that the price of tin has, in a great measure, caused the debt now against us. I see, in looking over the tin sale book, that the difference between 85*l.* per ton and what we have really made of our tin the last eight months amounts to over 1300*l.*, and I believe no one thought a short time since that tin would be down as low as 85*l.* I mention this to show that a few pounds per ton will tell considerably on our returns. I cannot tell what to say more for your guidance. As far as I know I have laid the whole truth before you, and trust we shall yet have success in our future development.—S. HARRIS.

The CHAIRMAN said that Capt. Josiah Thomas, as Mr. Trelawny's agent, had been called in with a view to obtaining the best opinion as to the position and prospects of the mine. He (the Chairman) was sorry he again appeared before the shareholders without being able to communicate anything satisfactory. The call recommended by the committee was a necessity, because the company was indebted to that amount. He had been connected with the mine from the commencement; he had seen its periods of high prosperity, and likewise its periods of deep depression, but he had never seen a period exactly parallel to that in which they now found themselves. The conditions were different; the lode had been at times in as poor a condition as now, but they had always fallen upon something good, enabling them gradually to hold up their heads. Such was the case two years since, when the mine was set on tribute. They had then the good fortune to discover the rich deposit of tin which they had since been working upon. It was an old saying in Cornwall that one-half the mines in the county had been saved by tributers, and he might say that Great Vor at that time was saved by tributers. The appearance of the ends and levels was poor, without any indications to encourage them to continue development; but, however poor, a valuable deposit of tin was discovered, from which they had been for the last two years deriving the greater proportion of their returns. They had at Metal a considerable amount of available tin of uncertain value, but which might fairly be estimated at between 7000*l.* and 8000*l.* It might be more, or it might be less; but, under any circumstances, there was no doubt a very considerable quantity of tin left that would be a very material help to them. As to the western ground, he could not help expressing his great regret at the long time that had occurred since explorations were there commenced, and at the great cost incurred—he would not say absolutely without profit, because they had had occasionally a good piece of tin ground; but latterly they had been continually meeting with small cross-courses, which disordered the lode, so that they were now almost like commencing a new mine, for it was impossible to say whether they had passed through all the cross-courses, although the ground had been looking better in the 164, encouraging the hope that they might yet find something in that direction. It had been the general opinion of all eminent mining authorities that there was a very good prospect in that ground. There was no doubt that in Old Wheal Metal shaft, if not quite vertically over where they were driving, yet towards which they were driving, a good lode existed; and although for several fathoms it had not been very encouraging, varying as all lodes did, there was no reason to suppose that it would not "make" again in depth. All the mines in the neighbourhood were essentially "bunchy" mines, and when the bunches were reached they almost invariably proved to be very rich. It had always been

an axiom that parallel lodes "make" mineral between the parallel cross-courses, and the old mine had proved itself to be very good between those cross-courses, realising very great riches. Upon that principle it had been supposed that by prosecuting their works westward remunerative results would be obtained. Personally he was bound to say they had a right to expect it, but whether they would find the lode compact west of the cross-course no one could say. The suggestion of their agents was a very fair one—namely, to drive 20 fms. further westward, and if nothing be then found justifying a continuance of operations, practically they had better shut up the mine. He did not know what fault could be found with such a suggestion; and there was every chance of finding something of importance. The reports submitted were so clear and exhaustive that shareholders were able to form an accurate opinion as to what course should be adopted. He then moved that the accounts be passed and allowed, which was put and carried.

The CHAIRMAN proposed that a call of 5*s.* per share be made.

Mr. WALKER seconded the proposition.

A SHAREHOLDER said it was the first time he had attended one of these meetings, but, as the representative of Mr. Cole's estate, suggested that the property should be realised, and the assets divided among the shareholders.

The CHAIRMAN said any shareholder had the option of relinquishing his interest, but the call now proposed was necessary to pay off existing debts. If the mine were now stopped, it would not have been fully tested, and possibly some one else might come in, and, by simply carrying out what their agents now proposed, really take possession of a good mine; it would not by many be the first time such a thing had occurred. The present payment of dues on the reduced scale would make a difference of about 600*l.* per annum.

Mr. VANSITTART reminded the shareholders that the position of the company had been adversely affected by the coal, iron, and labour markets and the depressed price of tin. Iron and coal were falling in price and tin was improving.

The CHAIRMAN said if they were realising the same price for their tin that they did 15 or 18 months since, they would not only be meeting the costs, but also have a surplus, irrespective of the difference in the price of coal of something like 7*s.* or 8*s.* per ton upon a consumption of over 400 tons per month. The price of tin in 1872 was 100*l.* per ton, whereas they realised for their last sale 70*l.* He believed there would be a reduction in the price of coal.

Mr. WILD supposed that while they were driving west they would also be stopping eastward?

The CHAIRMAN replied in the affirmative, adding that Captain Harris, in his report, just read, was very explicit on that point. He (the Chairman) was individually the largest shareholder in the mine, and had been connected with it for 20 years.

Mr. VANSITTART said that at any time they may get through these cross-courses, and find a good bunch of tin.

The CHAIRMAN said the last call was in December, 1859.

Mr. WALKER asked if the committee were unanimous in making a call?—The CHAIRMAN replied in the affirmative.

A call of 5*s.* per share was then made.

The committee of management were re-elected.

Mr. MOATES was re-elected auditor.

A vote of thanks to the Chairman and committee closed the proceedings.

## BURROW AND BUTSON MINING COMPANY.

At the recent special general meeting of shareholders, held at the offices of the company, on Thursday last,

Mr. J. W. WILLIAMSON in the chair,

The resolutions passed on Nov. 26, appointing a managing director, were unanimously confirmed.

A vote of thanks to Mr. Stevens and the Chairman terminated the formal proceedings.

## THE TERRAS TIN MINING COMPANY.

A meeting of shareholders was held in Dowell's Rooms, George-street, Edinburgh, on Tuesday.

On the motion of Mr. WHITE,

Mr. GREENE (secretary of the company) was called on to preside.

Having waited for a quarter of an hour after the advertised time of meeting for shareholders to assemble, the CHAIRMAN read the notice convening the meeting, after which he read the following report of the directors:

It is now about 10 months since your present directors, on a sudden emergency, took the affairs of this company into their hands. On entering office they found the accounts in such a state of confusion that even to the present time it has been found impossible to render any account of the transactions of the company prior to their taking office. They, however, discovered that although two dividends had been declared, there were pressing claims for over 3000*l.*, which the directors were called upon immediately to settle. To meet these unlooked-for liabilities, a special general meeting of the shareholders was convened, and held in London in March, for the purpose of considering the best means of raising capital to pay them, and to carry out the working of the mine. At that meeting it was resolved to create 10,000 additional shares of 1*l.* each. Of these additional shares 4900 were subscribed for; but although nearly all the shareholders sent their proxies to support the proposition, the majority of these new shares had been taken up by the directors and their personal friends. Unhappily, before these shares could be taken, a creditor applied for, and succeeded in getting, an order in the Stannaries Court for compulsory winding-up of the company; and it was only after considerable delay, and the cash payment of a large portion of the liabilities, that the works of the mine could be resumed. Some idea of the time consumed by the proceedings referred to may be made when you are informed that although these proceedings were commenced in the Stannaries Court early in April, it was only at the commencement of the present month that the books were given up by the Court. Your directors have, however, the satisfaction of stating that the accounts which will be presented to you to-day, made up to Nov. 30, 1873, show a balance in favour of the mine (taking the value of the machinery, which has not been included among the assets, at 2500*l.*) of 1214*l.*. Besides this amount there are standing to the credit of "New Shares Account" 5940 shares unissued. It appears to your directors that these shares should be created preference shares, and offered *pro rata* to the present shareholders at 20 per cent. preference. They finally have the pleasure of handing you the reports of Capt. Mitchell and Jewell, who have thoroughly looked into the merits of the property. As will be seen from Captain Mitchell's report, special reference is made to the obtaining of water-power to dress the produce of the mine. This has been anxiously taken into consideration, and your directors are advised that, should they be enabled to obtain the necessary permit, the dressing of the tinstuff by water-power would be of the utmost advantage to the company. With a view to the successful development of the company, the directors have, after considerable trouble, obtained the services of Mr. Lynch, of London, who, they have confidence in recommending to the position of managing director, as they certainly feel that their management of the affairs of the company at so great a distance, could not be anything like so efficient as in the hands of Mr. Lynch. Mr. Matthew Greene, who, during the period your directors have been in office, has acted as secretary, tenders his resignation, and they, on the suggestion of Mr. Lynch, recommend that Mr. Larchin, of 84, King William-street, London, be requested to accept the appointment, he having had a large experience in the conduct of mines, and particularly in the treatment of a similar class of ores to that at Terras. The directors would only further remark that the duties devolved upon them, and Mr. Matthew Greene (to whose personal exertions the shareholders are indebted for the rescue of their property from the Stannaries Court, and the continuance of the operations at the mine) have, since they undertook the management, been of a most anxious and arduous nature, and they have done all in their power to bring the affairs of the company out of the confusion in which they found them, and place them in as satisfactory a position as the limited time and means they have had at their disposal would enable them to do, and they believe if the recommendations they have made be carried out there is much probability of the company yet proving successful.—JAMES WHITE, CHARLES L. BARSTOW, J. J. LYNCH.

The CHAIRMAN then proceeded to read the following report by Capt. John Mitchell, one of the best miners, he remarked, in Cornwall, who had in the interval consented to take the management of the company:—

Nor. 29.—The adit level is taken up close by the stamp-plant, which is very convenient for the delivery of all tinstone that may be broken in this part of the mine, and extended 120 fathoms north on the elvan course. In the first 80 fathoms driving several caunter lodes and branches intersected and continued on with the elvan, which proved very valuable, as wherever these intersections take place the elvan is more productive for tin. Beyond this point to the present end the elvan is free from the influence of these lodes and branches, consequently it is more decomposed and less valuable. All the elvan in the first 80 fathoms, from the back of the adit to surface, is taken away and stamped, and from 80 to 90 tons of tin returned therefrom. Had this been stamped to itself, and not mixed with such an amount of rubbish as it was, it would have well paid for returning. In order to prove this piece of ground more fully, which I think is a very fair speculation, especially looking at the small amount of capital (3000*l.*) it will require, I would recommend a shaft should be sunk about midway, where these lodes and branches intersected the elvan, 40 fathoms deep, and at every 10 or 12 fathoms sinking, extend a level north and south on the elvan to prove its value, where I have every reason to believe it will well repay for laying open for tinstone. To accomplish this object, some machinery will be required to draw the water, which can be easily done by attaching flat rods to the stamps; 8-inch pitwork will be quite large enough to draw the water. The engine, when put in proper order, will be powerful enough to do this and stamp all the stuff that may be raised. The probable cost of the erections and materials which will be wanted, including a new cylinder for the engine, will be about 350*l.*. The monthly cost afterwards will be from 120*l.* to 150*l.*. The returns will depend on the value of the elvan laid open by sinking the shaft and driving the levels, as the reserve above the adit level will not pay for stamping at the present price of tin, and with the high price of labour and materials. Respecting the water

arrangement, causing a movement of one tooth of the scape-wheel actuated by the clock spring. The motion is consequently communicated to the spindle and to the writing table and carriage, which is thus moved into a position suitable for the printing of the next letter. The pistons corresponding to the letters to be printed are depressed in their order, and the letters appear on the paper in a line vertical to the operator. Speed is considerably augmented by the arrangement of the knobs or pistons into groups, easily covered by the whole of the 10 fingers. When a line or pistons is completed the hammer strikes the bell as a signal that a new line of printing is commenced. This is effected by pushing the carriage of the writing table forwards or backwards by hand the distance required between the lines. That the distance may not be exceeded and shall be attained, a rack-and-pinion movement is employed. After some practice the pistons can be worked at the rate of ten per second, or three or five times quicker than ordinary writing with a pen. All kinds of paper can be employed, and of any thickness, by means of a vertical adjustment of the writing ball. If 10 layers of this paper are employed, with interposed layers of carbonised paper, all 10 pieces receive the same impression. By passing these ten impressions with interposed tissue paper through rollers, double the number of copies are obtained.

## SILVER MINING IN BOLIVIA.

Some six months since attention was prominently directed to the silver mines of Caracoles, in the Republic of Bolivia, by the reception of advices to the effect that the ore deposited in the warehouse of the Descubridora Mines in a fortnight was not less than 1000 quintals per day, with an average standard of 75 marcs per cajon, the cajon being 64 quintals of 100 lbs. each, and that the ore delivered from the other mines in the same district amounted to 8000 quintals, with an average standard of nearly 130 marcs per cajon; whilst during the month the steamers chartered by Messrs. Dorado and Volekman would take 27,000 quintals, or 109,720*l.* worth of ore. This statement, coupled with the facts of the mines being situated only about 120 miles from the Pacific Coast, and of a railway being in course of construction to connect Caracoles and the excellent port of Megillones, whilst another is proposed for placing Antofagasta likewise in communication with the port, cause the district generally, and the Descubridora Mines in particular, to come into high favour, and a company—the ANGLO-BOLIVIAN SILVER MINING COMPANY—has now been formed, with a capital of 100,000*l.*, in shares of 5*l.* each, for purchasing and working "silver mines in the rich mineral district of Caracoles," and from the mines which it is proposed to work every confidence is felt that the company will have a lucrative field for enterprise. It is remarked that the Descubridora, or Discoverer's Mines, situated in this district, were discovered less than three years ago, and are giving extraordinary results. The statistics published in the *Caracolino* of Feb. 28 show the yield in January last amounted to 82,114 marcs of 8 ozs., or about 165,000*l.* (131,382*l.* at 4*s.* per oz.), whilst the *South Pacific Times* of March 28 shows the total yield of the principal mines at Caracoles, including the Descubridora, in December was 142,796 marcs, or at the rate of about 3,500,000*l.* per annum.

With regard to the general richness of the district a number of silver ore specimens therefrom, fifteen in number, have been assayed by Mr. W. T. Rickard, F.C.S., and found to contain from 269 ozs. to 20,330 ozs. of silver to the ton of ore, only three of the specimens giving less than 2000 ozs. to the ton, and ten of them yielding more than 4000 ozs. to the ton. The mines secured by the company embrace the Prusiana, in which the lode shows itself throughout the entire sett; width about 20 in., angle 40° east. In this mine there are two places in which work is being carried on; the first, at the north part of the sett, has been proved at a depth of about 8 fms., and is 1 ft. in width. Two samples of ore, taken from different places of the lode, produced on an average 60 ozs. to the ton. The La Paz, where the lode has been sunk upon to a depth of 11 fms., width about 1 ft., with an angle of 20° east, an assay made produced 45 ozs. of silver to the ton. There are several lodes which cross this sett, and which will be productive as the mine gets opened up. The Elvira is situated in a valley called Quebrada Honda, distant from the Merceditas del Alto Peru Mine about 70 fms.; the lode runs about 52° east, width 2 ft., composed of spar and lead, the country being of the nature for producing silver; the depth gained is about 4 fms. vertical. At a little more than 2 fms. the lode is heaved by a manto, and has been cut below that, this requiring a short cross-cut, and when taken will contain a good percentage of silver, as a sample of the lode at the 4 fms. gave 50 ozs. to the ton. The Candelaria is situated about 140 yards from the public road of the valley called Quebrada Honda; the lode runs about 10° east, and from the surface to a depth of about 5 fms. vertical, judging from the extent of ground opened, the ore must have been of a good quality, some of the refuse at surface having given 80 ozs. to the ton. And the Minina is situated by the side of and parallel with the Candelaria Mine; width of lode about 32 in.; depth gained about 5 fms. vertical; lode well defined, composed of spar, iron, and lead, an assay of which gave 64 ozs. of silver to the ton.

The mines have been carefully inspected and favourably reported upon by both Spanish and English engineers. Señor Meno Pabst, for instance, reports, with reference to the Prusiana, that, besides the Prusiana lode proper, the sett contains several other well-defined lodes, which pass completely through it; also the lodes from the rich and celebrated Niza Mine, which has been so productive, it being stated that ultimately these lodes of the Niza Mine have been intersected in the Cleopatra, Surapato, and Soeturnina Mines with a good result, each of these being situated to the south of the Niza Mine, from which he infers that the Prusiana Mine is of great importance, and that, being properly worked, he believes it will make one of the richest mines in the district. He has no doubt that the Prusiana Mine, properly managed and well opened up, will respond to the great expectations formed of it, and, according to observations and examinations made, it is called to occupy a distinguished position among the rich mines of Caracoles. Capt. Joseph Lean, who reports upon all the five mines, considers that even in their present state the mines can produce sufficient ores to pay in part the expenses necessary to properly develop them. And Capt. W. Bray remarks that the three or four mines referred to can be purchased and brought into a profitable state of working with an outlay of 20 per cent. of the capital proposed, or even a small portion of that amount, the deposits when intersected being of so rich a character. It is not to be presumed that by stating a mine to be 10 fms. in depth the lode is opened up and proved for the length of the sett at that depth, this being generally at one particular place, where the regulation shaft of 4 yards has been sunk. From the preceding remarks it will be seen that he holds a high opinion of the importance of Caracoles as a silver mineral district; in fact, he knows of no investment at present equal to it, and which offers such a field for large profits. He has had an opportunity of acquiring a practical knowledge, during 20 years, of the management of silver mines in the district of Copiapo, in the Republic of Chili, but does not know of any district presenting indications that guarantee the certainty of such great success as the one referred to, and in particular those selected by this company. The prospectus will be found in another column.

TREATING PULVERULENT IRON ORES FOR SMELTING.—The invention of Mr. C. COCHRAN, of Stourbridge, consists in agglomerating small iron ore into lumps or briquets, so as to render it better suited for smelting in blast-furnaces. For this purpose the small ore is mixed with clay, and is then pressed and dried or calcined. Certain ores which have themselves sufficient cohesive property may be so treated without admixture of binding material. Ores of a friable nature may be ground small and treated as above.

"SYNDICATING."—One of the most remarkable commercial features of the day is the formation of "Syndicates," the name of which gives little information to the uninitiated as to the nature of the operations conducted. Our old friend Johnson only gives the word in the verb form, and defines it as meaning "to judge, to pass judgment, or to censure," adding, "an unused word, not in use;" but a somewhat older dictionary maker, Bailey, has "Syndick, a person deputed to act for one corporation or community," and "Syndicate, the place or action of a Syndick;" and this appears to be the origin of the word now so familiar in financial circles. The term is now applied to a body formed for the purpose of occupying a middle position between persons who are the owners of property or interest and the general public. An active agent or promoter discovers a good property that may be greatly improved if more capital can be employed in it; he makes a conditional contract for its purchase by a certain time and at a certain price, and then sets to work to "syndicate" a company, fixing the capital required for the purchase at perhaps two, or even three, times as much as he has undertaken to give, the difference being the reward for his enterprise. Collieries, mines, and shipping are among the objects as yet especially favoured by this syndicating process. It is obvious that by such an operation valuable property may be brought into the market, but it is equally obvious that an immense field may be opened up for "bolstering up" very doubtful concerns, and floating a very large number of companies of something more than doubtful stability.—*Chambers of Commerce Chronicle.*











## THE GALVANOMETER AND ITS USES.

Applied electricity now occupies so prominent a place amongst our everyday necessities that without some knowledge of the nature and uses of the various instruments and apparatus connected with it, one not unfrequently finds himself at a loss, even in the midst of ordinary conversation, so that Mr. Haskins's pocket book volume\* just issued will be very acceptable to a large number of readers. All the principal electrical laws and rules are ably and carefully condensed into less than 50 pages, and as each law and rule is elucidated by examples of its practical application, the utmost possible advantage may be derived from the study of the book. Being essentially a manual for those requiring the information in such a form as to be readily available when measurements have to be made, the discussion of the theories upon which the several rules are based is very judiciously limited, yet in the explanatory chapter ample elementary instruction is given to render every statement in the book thoroughly comprehensible even to those who have not had the benefit of hearing anything of the subject in the lecture room. Mr. Haskins appreciates the fact that to enable the student to work understandingly in galvanometric measurements it is necessary that he should comprehend the laws upon which such measurements are based; he, therefore, furnishes him with all requisite particulars concerning the resistance of conductors, units of measurement, electromotive force, quantity, cause of the flow of the current and the laws which regulate it, quantity and tension of batteries, proportioning battery to line, speed of current, effect of atmospheric moisture on insulation, joint resistance of lines, galvanometers, rheostats, and shunts; and as an example of the concise and lucid manner in which he states his facts, reference may be made to the paragraphs describing electromotive force, quantity, and tension.

Electromotive force Mr. Haskins defines as the power which a cell of battery possesses of causing the transfer of its current from one place to another. In other words, the electromotive force of a current is its power of overcoming resistance—its energy. To use a familiar comparison, electromotive force is to a current what pressure is to steam. Quantity is defined with equal brevity and precision as the amount of current that is evolved in a given time by a cell of battery. This amount may be increased or diminished by lessening or increasing the resistance in the battery and external thereto. With reference to quantity and tension of batteries, confusion upon which frequently leads to both inconvenience and disappointment. Mr. Haskins explains that the quantity generated by a cell of battery depends upon the size of its plates—the tension upon the number of cells. Hence a battery of 40 cells, while giving 40 times the electromotive force or tension of one cell, will furnish only the same quantity of current; and in this connection he very neatly defines electromotive force as tension in a state of motion, and tension as electromotive force in a state of rest. Each cup of battery has its own quantity, which is urged forward to the next cell by virtue of its own electromotive power. The current from the cell at the positive pole of the battery is pushed out to the line wire, the current from the next cell taking its place—the last cell being supplied through the ground wire from the earth. But the current from each cell when carried forward passes to its neighbour parts, with its energy or electromotive force and the current from the first cell is pushed forward to line, and thence to the ground at the further end of the line with all the electromotive force or energy of all the cells. And then he goes on to explain how, with a given total resistance, the flow of current may be increased.

The second chapter contains descriptions of Bradley's tangent galvanometer, the Gauguin galvanometer, the differential galvanometer, the Wheatstone bridge, and the sine galvanometer. In the third chapter formulae are given to measure electromotive force, and internal resistance of a battery by the method of equal deflection and by direct measurement, and there are careful explanations of the methods of testing for insulation and conductivity, and for grounds and crosses. Several ingenious methods, devised by Mr. Haskins himself, are also inserted, and they will certainly be appreciated by practical men. By way of example, his method of testing for insulation over two lines may be stated. Suppose you wish to test the insulation of a wire which is (say) 50 miles away. You may connect it in circuit with a line of better or worse condition running from your location, and arrive at the measurement of the further line thus—First measure the connecting line, open at the junction, reduce this insulation to mileage resistance, then connect both lines, closing the further one at the distant end, and measure both for insulation, reduce this also to miles. If the first line be worse, the average per mile in the second test will be better than in the first, because the better average of the second line has made the whole show better; this excess belongs to the second line, and must be added to it, divide the excess per mile by the number of miles of the first wire, and add this to the second measurement. The result will give the correct insulation resistance of the second wire. If the first wire be the best the process must be reversed. An example is then given, showing the application of the method, but the process is so simple and so clearly stated that it is unnecessary to reproduce it.

As a manual of galvanometric measurement it will, without question, do all that it professes to do; it will enable the student with a little practice to make land line measurements with dispatch and accuracy. If the memory cannot be relied upon to retain the facts given it will prove an invaluable field companion, and more especially so, as besides giving the rules, formulae, and the fullest instruction as to the method of applying them, the calculations will be much facilitated by the well-selected series of tables appended, which includes tables of specific resistance of different metals, of weight and resistance of copper wires, of natural tangents, and of squares, cubes, square roots, and cube roots, so that all complicated calculations will be avoided. The book is altogether excellent.

\* "The Galvanometer and its Uses: a Manual for Electricians and Students." By C. H. HASKINS. New York: D. Van Nostrand, Murray and Warren Streets. London: Trubner and Co., Ludgate Hill.

## QUALITATIVE BLOWPIPE ANALYSIS.

Although many of the educational works placed in the hands of the German student are very profound and complete, it must be admitted that many of the elementary books written by French authors are much more popular and attractive, and at the same time contain quite as full an outline of the subject to be taught as the ordinary student is likely to require. The new edition of Professor Elderhorst's manual,\* just completed by Professors Nason and Chandler, the former connected with the Rensselaer Polytechnic Institute at Troy, and the latter with Columbia College School of Mines, New York, may, as far as generally is concerned, be referred to the best class of French works written with similar objects. Being a comparatively recent work, it is necessarily less complete and exhaustive than the large treatise of Plattner, recently translated by Prof. Cornwell, also of Columbia College; but inasmuch as in the original compilation of the manual Elderhorst not only availed himself of the researches of Plattner, but also of Berzelius, Von Kobell, Dana, and Mitchell, the book is worthy of high commendation as a thorough epitome of what may be regarded as the most important discoveries and suggestions of each, whilst in the present edition, although all necessary alterations and additions have been made, the original plan of the work has been preserved.

The analytical apparatus and reagents having been described in little more than half a dozen pages, the second chapter explains the general routine of blow-pipe analysis, embracing the examinations in a closed glass tube, in a glass tube open at both ends, on charcoal or on platinum, in the platinum-pointed pinners, with borax and salt of phosphorus, with carbonate of soda, and with solution of cobalt, yet all included within another twenty pages; and the student is given ample instruction as to the mode of procedure, and as to the readiest method of observing the reactions. Thus, with regard to the examination in a closed glass tube, or a matras, it is observed that the assay piece is introduced into a small glass tube, sealed at one end, or into a small matras, and heat applied by means of a gas or spirit lamp. The heat must at first be very low, but may be gradually raised to redness, if necessary; and then what is to be learned from this examination is at once pointed out—whether the substance is entirely or partly volatile or not, whether it gives out a gas or a vapour, whether it sublimes, and whether it undergoes any change or remains unaltered. Then with regard to those substances which vapourise, it is shown how to recognise oxygen, sulphurous acid, nitrous acid, carbonic acid, cyanogen, ammonia, hydrofluoric acid, and iodine. The substances which yield sublimes are treated with similar completeness, those white, or possessed of a peculiar odour, giving a metallic mirror, or possessing a distinct colour, being placed in separate classes for complete examination. In the succeeding chapter the special reactions for the detection of certain substances when in combination with others are explained. Then there is a chapter on the characteristics of the most important ores, and their behaviour before the blow-pipe, and to solvents. The systematic method for the determination of inorganic compounds, given in the fifth chapter, is chiefly from Laurent's "Analyse des Chaux-mères," one of the most concise and convenient methods that could be wished for; whilst the remaining chapters are devoted to the determination of minerals by means of the blow-pipe, aided by humid analysis, and to coloured flames, flame reactions, and spectrum analysis. To render the work complete, tables are given showing the behaviour of the alkaline earths and the earths proper before the blow-pipe, the behaviour of the metallic oxides before the blow-pipe, and the metallic oxides arranged with reference to the colours which they impart to the flame.

The book has all the advantages of the original edition with regard to conciseness and excellent arrangement, and has been carefully brought up to the knowledge and views of the present day. The names of minerals and ores, and in many cases the formulae, have been made to agree with those given in the last edition of Dana's Mineralogy; and as an instance of the late period to which the information is brought down, it will suffice to mention that Professor Cornwell's very neat method of detecting bismuth in presence of lead and antimony, only published in the "American Chemist" a few months since, as well as others equally recent, are fully referred to. The practical mineralogist, as well as the student, will find the volume a very useful companion.

\* "Elderhorst's Manual of Qualitative Blowpipe Analysis and Determinative Mineralogy." Edited by HENRY B. NASON, Ph.D., and CHAR. F. CHANDLER, Ph.D. Fourth Edition, revised and enlarged. Philadelphia and London: T. Ellwood Ziegler.

**GEOLOGICAL PRIMER.**—The concise yet useful character of the series of *Shilling Science Primers* now in course of publication by Messrs. Macmillan and Co., of Bedford-street, Covent Garden, has already been referred to, and the fifth primer—that on *Geology*, by Dr. GRIEKE, F.R.S., the Director of the Geological Survey of Scotland; and *Mineralogy*, Professor of Geology and Mineralogy in the University of Edinburgh—is certainly entitled to be regarded as one of the best yet issued. In the 128 pages to which the volume is limited the *Primer* has succeeded in giving, in an

excellent introductory chapter, a good account of the different kinds of stones and what we have to learn from them, and a really admirable outline of the science as learnt from the study of the various formations from the sedimentary rocks downwards. In dealing with the sedimentary rocks he explains what sediment is, how gravel, sand, and mud are made; how these become sedimentary rocks, and how the remains of plants and animals came to be found in them. Then he refers to the organic rocks, or those formed from the remains of plants and animals; and afterwards to the igneous rocks and the crust of the earth generally. The primer is well illustrated, and is altogether a very useful little handbook.

**POST OFFICE LONDON DIRECTORY.**—The high price of fuel and labour has seriously interfered with many branches of industry, yet the new annual edition of the Post Office London Directory, although still of greater size as compared with the last year's volume, has been issued with its accustomed regularity, and that, too, without any increase of price; it seems, however, that even the proprietor of the "London Directory" cannot continue indefinitely to pay increased rates for both materials and labor without being compelled to ask his customers to bear a portion of the increased burden. The volume for the ensuing year 1874 remains as before, but it has been found necessary to make the price of the large edition for the future £1. 12s. 6d., to subscribers, and 2s. to non-subscribers. Even at the advanced rates the volume is so exceedingly cheap that the alteration is not likely to diminish the large annual sale by a single copy, so that the proprietor will continue to receive the encouragement his energy and the utility of his work so fully entitle him to. The present year's volume contains no less than 2818 pages, being 40 or 50 pages more than its immediate predecessor, and as usual arranged so as to facilitate to the utmost reference to the volume and the obtaining of the information sought in the shortest time possible. The issue of the directory is a few days earlier this year, yet every correction down to within a week of publication seems to have been made. Thus, the death of Vice-Chancellor Wickens, which was announced on Oct. 27, is noticed throughout the work, the name being removed from the official index, and from two places in the Law directory, whilst in the Court portion the name of the widow is substituted for that of the deceased Vice-Chancellor. Nor is this all, for the name of his successor is inserted in substitution throughout,

and the Vice-Chancellors' chambers is corrected in the Commercial directory. The amount of labour and attention which such alterations involve is enormous, and the later they come the greater is the inconvenience attending the correction, yet that trouble has not been permitted to interfere with securing accuracy to the latest moment is evidenced by the fact that the names of the new School Board for the Metropolis, only elected on Nov. 27, are all given, although we received the volumes of the Directory "is a work which few men of business can afford to be without, and whilst it is issued with the regularity and care which at present characterise its publication, it need fear no successful competitor."

**GUNPOWDER MOTOR.**—The object of the invention of Mr. JOSEPH M. WELBOURN, Caledonia, Ohio, is to construct an engine which is driven by the explosive force of powder charges. The invention consists in the introduction and explosion of powder charges into chambers, which are alternately discharged to act on pistons, which turn the driving-wheels, and are regulated by suitable mechanism. The base frame on which the engine is placed is of oblong shape, and contains two powder chambers arranged parallel to each other in longitudinal direction at both sides. The driving-wheels produce, by alternately completing one half of a revolution on each wheel, rotary motion of the shaft from the reciprocating motion of the pistons. Each powder chamber is closed by an adjustable breech piece, which may be detached for cleaning out the chamber. The breech-fitting piston moves in the chamber, its piston-rod connecting by a cross-pin with a strong spiral spring, which is also applied by cross-head and pitman to the side of a driving wheel. The required quantity of powder is introduced, in cartridge form, into the chamber by means of a vertical easing, which is arranged on guide rails placed on the top of the chamber. A brush of casing serves to secure the cartridge in recess of the sliding piece, which is carried forward and backward in guide rails. On the forward motion of the slide the cartridge drops into a chamber, to be carried back toward the breech piece by the returning piston, and be charged by the discussion against the breech-block. The piston is, by the explosion, forced forward again, and causes, by its action on the pitman, the rotation of the wheel. The smoke and gases escape through side apertures, admitting the immediate re-charging of the chambers.

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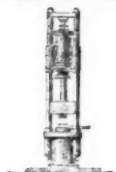
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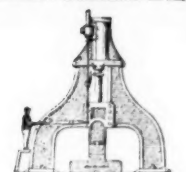
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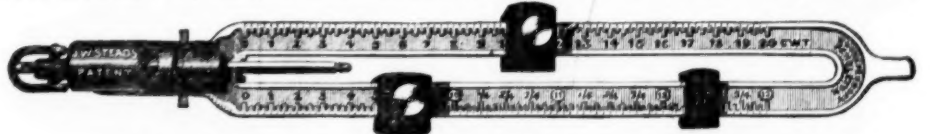
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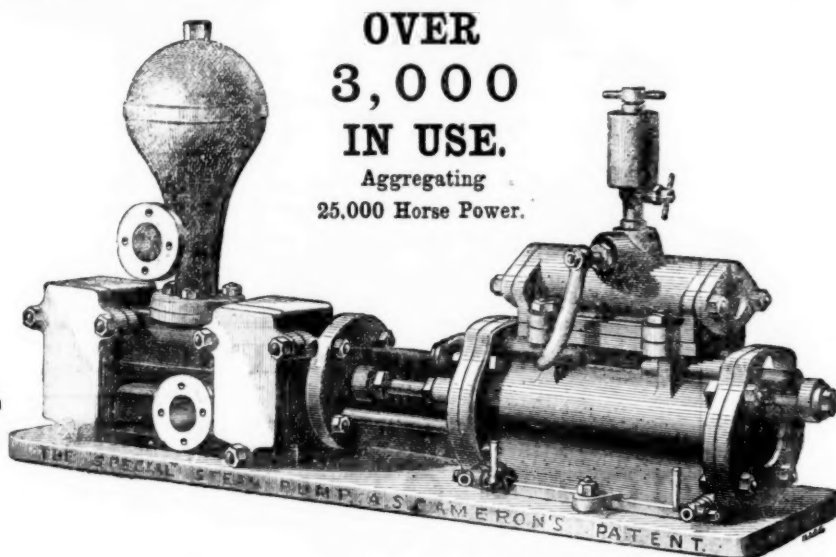
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SLIDE VALVES  
AND PUMP VALVES ALL  
EASY OF ACCESS.



OVER  
3,000  
IN USE.  
Aggregating  
25,000 Horse Power.

ALL FITTED WITH  
HOLMAN'S PATENT  
BUFFER VALVES,  
which are  
RELIABLE & DURABLE  
under  
1,500 FEET HEAD.

It is with regret that we find it necessary to refer to the Advertisements of another Firm, but Messrs. HAYWARD TYLER & Co. having by public Advertisements and private Circulars adopted the unusual course of directly contradicting our advertised statements as to our Award at the Vienna Exhibition, we feel it to be due to our Agents and Friends, no less than to our own reputation, to state in the most absolute manner that the International Jury of Class XIII. have awarded us

## THE "MEDAL FOR PROGRESS"

## For The "Special" Direct-Acting Steam Pumps

### AS WELL AS FOR TANGYE'S HORIZONTAL STEAM ENGINES,

As will be seen from the subjoined Official Communications:—

OFFICES OF THE ROYAL BRITISH COMMISSION,  
VIENNA, 18th Nov., 1873.

Gentlemen,  
With reference to recent correspondence, I am directed by Her Majesty's Commissioners to transmit to you the enclosed Extract in the original German, from a letter addressed to me, under date of the 14th inst., by His Excellency Baron Schwarz Senborn, respecting the Awards made by the International Jury to your Firm.

Messrs. Tangye Brothers & Holman,  
16, Laurence Pountney Lane,  
London.

I have the honour to be, Gentlemen,  
Your obedient Servant,

(Signed) P. CUNLIFFE OWEN,  
Secretary.

TRANSLATION.

UNIVERSAL EXHIBITION, 1873, VIENNA,  
GENERAL DIRECTION, 42, PRATERSTRASSE, 14th Nov., 1873.

Highly Honoured Sir,

In pursuance of your esteemed letters of the 2nd and 5th of this month, I have the honour to bring under your notice that the International Jury of Class XIII. have as a matter of fact Awarded the Medal for Progress to the Firm of Tangye Brothers & Holman for Steam Engines and Pumps.

P. Cunliffe Owen, Esq.,  
Secretary of the Royal British Commission.

(Signed) SCHWARZ SENBORN.

WE ARE THUS ENTITLED TO STATE THAT

## THE ONLY "MEDAL FOR PROGRESS" FOR DIRECT-ACTING STEAM PUMPS

FOR MINING AND GENERAL PURPOSES, HAS BEEN GRANTED TO

## TANGYE BROTHERS & HOLMAN,

the Award to HAYWARD TYLER &amp; CO. is simply and specifically FOR "FEED PUMPS" (BOILER FEEDERS) ONLY.

The FOLLOWING is an Extract from a Letter received by Tangye Brothers & Holman, from Dr. Anderson, Royal Arsenal, Woolwich, Referee of the Juries at Vienna Exhibition, dated 23rd October, 1873:—

"I am much struck by the statement which you put before me to-day in regard to the magnitude of your transactions in the manufacture of Steam Pumps and Steam Engines. I consider that your firm is not without blame in not laying it before the Jurors in Group XIII. at Vienna. If you had done so an additional

DIPLOMA OF HONOUR would have been obtained FOR ENGLAND."

## TANGYE BROTHERS & HOLMAN,

### LAURENCE POUNTNEY LANE, LONDON.

And Birmingham (TANGYE BROS.), Cornwall Works, Soho.



BY ROYAL

**H. R. MARSDEN,**

LETTERS PATENT.

**BLAKE MACHINE****ORE CRUSHERS, WITH THE NEW PATENT CUBING JAW.**

Has received 30 First-class Gold and Silver Medals.

**750 NOW IN USE.**

ALSO,

**NEW Patent EMERY CRUSHERS,  
CEMENT CRUSHERS,  
MACHINES for making GRAVEL  
AND  
ROAD METAL.**

**COPROLITE CRUSHERS,**

Small Handpower Machines for Crushing Samples, &amp;c.

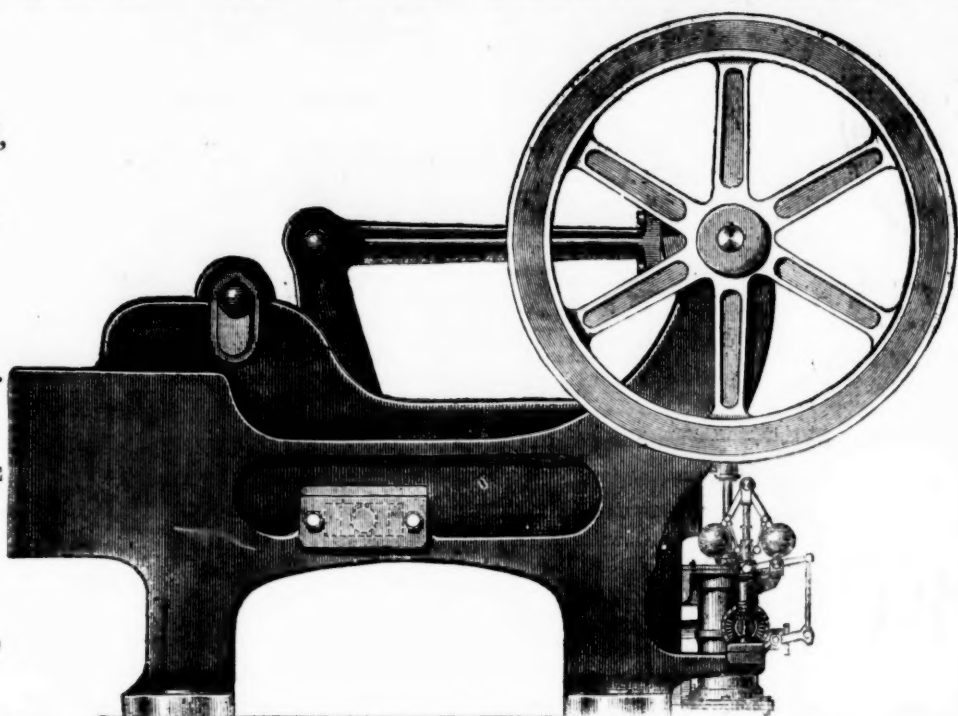
**SECURES FIRST-CLASS PRIZE MEDALS  
WHEREVER EXHIBITED.**

**ARE IN USE IN ALL PARTS OF THE WORLD. IMMENSE  
SAVING OF LABOUR.**

Users write—"It is a fascination." "A wonder." "Your Ore  
Crusher is all that we could desire."

For illustrated catalogues, circulars, and testimonials, apply to—

**H. R. MARSDEN, Soho Foundry,  
LEEDS,  
ONLY MAKER IN THE UNITED KINGDOM.**



REFERENCES

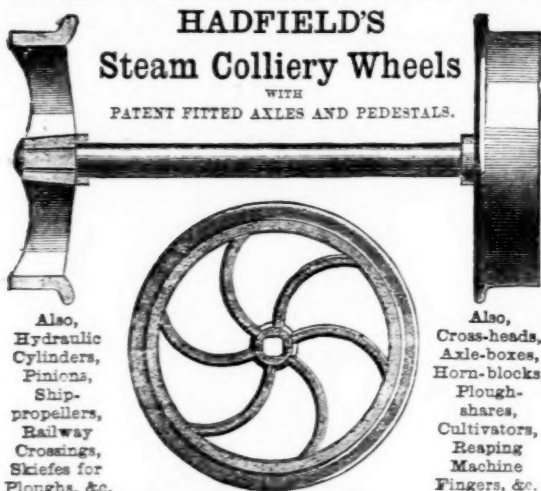
TO

ALL PARTS

OF THE

WORLD.

TO COLLIERY PROPRIETORS, MINING ENGINEERS, &amp;c.

**HADFIELD'S****Steam Colliery Wheels**WITH  
PATENT FITTED AXLES AND PEDESTALS.

Also,  
Hydraulic  
Cylinders,  
Pinions,  
Ship-  
propellers,  
Railway  
Crossings,  
Skies for  
Ploughs, &c.

Also,  
Cross-heads,  
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Fingers, &c.

**Hadfield's Steel Foundry Company,**

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ATTERCLIFFE, SHEFFIELD.**

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CAST STEEL FOR PUNCHES, TAPS, and DIES

TURNING TOOLS, CHISELS, &amp;c.

CAST STEEL PISTON RODS, CRANK PINS, CON

NECTING RODS, STRAIGHT and CRANK

AXLES, SHAFTS and

FORGINGS of EVERY DESCRIPTION.

DOUBLE SHEAR STEEL, T. TURTON

BLISTER STEEL,

SPRING STEEL,

GERMAN STEEL,

Locomotive Engine, Railway Carriage and Wagon

Springs and Buffers.

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LONDON WORKS, 24, QUEEN STREET, CANNON STREET, CITY, E.C.

Where the largest stock of steel, files, tools, &amp;c., may be selected from.

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PATENTERS.

(ESTABLISHED 1770.)

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IMPROVED

**PATENT FLAT and ROUND WIRE ROPES**  
from the very best quality of charcoal iron and steel wire.

**PATENT FLAT and ROUND HEMP ROPES,**  
SHIP RIGGING, SIGNAL and FENCING STRAND, LIGHTNING CON  
DUCTORS, STEAM PLOUGH ROPES (made from Webster and Horsfall's  
patent steel wire), HEMP, FLAX, ENGINE YARN, COTTON WASTE  
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UNIVERSITY WORKS, MILLWALL, POPLAR, LONDON.

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CITY OFFICE, No. 2, LEADENHALL STREET, LONDON, E.

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**THE SOUTH WALES EVENING TELEGRAM**

(DAILY), and

**SOUTH WALES GAZETTE**

(WEEKLY), established 1857.

The largest and most widely circulated papers in Monmouthshire and South Wales.

CHIEF OFFICES—NEWPORT, MON., and at CARDIFF.

The "Evening Telegram" is published daily, the first edition at Three P.M., the  
second edition at Five P.M. On Friday, the "Telegram" is combined with the  
"South Wales Weekly Gazette," and advertisements ordered for not less than six  
consecutive insertions will be inserted at an uniform charge in both papers.  
P.O.O. and cheques payable to Henry Russell Evans, 14, Commercial Street  
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**STAMP IT OUT WITH HIBBERT'S PATENT ANTISEPTIC.**

See Hibbert's New Theory and Practice of Medicine for Human Beings and

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DEPOS: 145, STRAND, LONDON. WORKS: MANCHESTER.

**COAL-CUTTING MACHINERY.**

**W. and S. FIRTH undertake to CUT, economically, the hardest  
CANNEL, ANTHRACITE, SHALE, or ORDINARY COAL, ANY  
DEPTH, UP TO FIVE FEET.**

Apply.— **16, YORK PLACE, LEEDS.****COAL-CUTTING BY MACHINERY.****WILLIAM BAIRD & CO'S****COAL-CUTTING MACHINES**

[GLEDHILL'S PATENT IMPROVED].

Messrs. BAIRD have now made arrangements for the manufacture and supply of their PATENT  
COAL-CUTTING MACHINES, a number of which may be seen in successful operation in their mines  
at GARTSHERRIE, and elsewhere. In these mines the Machines are undercutting a "face" of coal of  
from 300 to 400 feet, to a depth of from 2 feet 9 inches to 3 feet 6 inches; this is effected in a "shift"  
of from eight to ten hours. If necessary, the undercutting can be increased to 4 feet.

All information on the subject given, and orders booked, by the SOLE AGENTS—

**FERGUSON & REID, GLASGOW.****THE DIAMOND DRILL.****PROSPECTING OR TRIAL BORING FOR MINERALS.**

The DIAMOND ROCK BORING COMPANY (LIMITED) is PREPARED to UNDERTAKE CONTRACTS at FIXED RATES  
for PROSPECTING or BORING for MINERALS of all kinds. Great speed is attained; work that formerly took years is done  
in the same number of months, and sample cores are brought up, showing the nature of the strata passed through, and enabling the  
minerals obtained to be analysed.

The company has a number of MACHINES in SUCCESSFUL OPERATION in different parts of ENGLAND, and the terms  
with particulars, will be supplied upon application to—

**THE SECRETARY, DIAMOND ROCK BORING COMPANY, LIMITED,  
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Established 1844.

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RAILWAY WORKS, LEEDS,

**ENGINEERS, FOUNDERS, AND LICENSEES.**

MANUFACTURERS OF IMPROVED STEAM ENGINES, BOILERS, PUMPS, &amp;c.

MAKERS, by Special Machinery, of PATENTED MECHANICAL INVENTIONS, comprising numerous Labour-saving Appliances  
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THE FIRST PRIZE MEDAL AT THE EXPOSITION UNIVERSELLE, PARIS, 1867, "For Improved Construction, Excellence of Material, and Superior Workmanship."  
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Also, THE MEDAL FOR MERIT AT THE VIENNA EXHIBITION OF 1873, "For Excellence in Material and Workmanship, the Employment of Improved Tools and  
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REDUCTION IN PRICE OF FEET'S VALVES, CONSEQUENT UPON LARGELY INCREASED SALES.

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